



KG-870 70-WATT
ALL-TRANSISTOR STEREO AMPLIFIER

CONSTRUCTING YOUR KNIGHT-KIT

The transistor amplifier you are about to build has been designed to deliver the highest standards of high fidelity performance. The construction information given here has been carefully worked out to guide you every step. **Please follow the instructions carefully, and work slowly.** In the end you will be rewarded with a fine amplifier and personal satisfaction from a job well done.

Choose a workplace that is well lighted, and has an outlet for your soldering iron. Such an area should allow you to work at a leisurely pace without too many interruptions.

When you are instructed to unpack your kit and check your parts, you will find it convenient to keep your parts sorted in egg cartons, muffin tins, or ice cube trays.

Several basic tools are required to build your kit. They are: a medium size screwdriver with a $\frac{3}{16}$ " blade; a small size screwdriver with a $\frac{1}{8}$ " blade; a pair of long nose pliers; a pair of diagonal wire cutters; a soldering iron rated at about 27 to 40 watts, or solder gun. Although they are not absolutely necessary, a set of nut drivers is very helpful.

UNPACKING

Check the contents of your kit against the parts list. This will help you become acquainted with the individual parts before you are required to use them. Any unfamiliar parts can be identified by comparing them with the parts identification photographs or wiring illustrations. The hardware and wire quantities given in the parts list are the minimum needed to construct the unit. There will usually be wires and hardware left over when the kit is completed.

NOTE: The front surface of the heavy "U" shaped chassis has a 4-degree slant. This causes the dress panel to slant by an equal amount and contributes to the modern appearance of this amplifier.

Assort the hardware by size. The hardware identification photograph is shown actual size to aid you.

In order to shorten the electronic component language, these parts have all been given "reference designations". Thus capacitors have C-numeral, and resistors R-numeral designations. Every electronic part in your kit has a specific letter-number "name": TR for transistors and their respective sockets; T for transformers; and S for switches. Terminal strips are known by "TS" numbers and can be identified by their photographs in the Parts Identification Chart. It is very important that you choose the right terminal strip during construction. Look for the number of terminals, how many are located left or right of the mounting foot, and whether or not the foot is also a terminal.

Capacitors come in many shapes, sizes and types. Most of the capacitors used in this kit are of the "electrolytic" type. These units have a positive + and a negative - lead. It is **imperative** that you connect these leads to the point indicated in the construction step. These capacitors are all

marked with two essential characteristics; capacitance, marked in microfarads (Mfd or μ fd) and voltage, (V). Typical markings are:

250 MFD 15V | 10 MF 6V | 10-25 DC

In each unit the first number is the capacitance in microfarads, the second number is the working voltage. Notice in the third example that the abbreviation for microfarad is missing, however you can still tell that this unit is a 10 μ f at 25V.

Ceramic disc capacitors have their value (capacitance) marked in either of two units. The first unit is identical to the electrolytic types, the μ fd.

The second unit is a million times smaller, it is the micromicrofarad ($\mu\mu$ fd). Disc capacitors often do not have the unit indicated on them. You can quickly tell what the unit is, however, by the numbers given. If the number starts with a decimal point, such as .0033, read it as .0033 μ fd. If a part is marked in whole numbers, such as 6800, read it as 6800 $\mu\mu$ fd.

Mylar capacitors (odd-shaped) are marked like the disc units. Some of the mylar units have a black line near one end or lead. Sometimes it is important that the lead close to the line go to a specific terminal. If it is important, you will be told which terminal it should go to. If no specific instruction is given, you may connect either lead to either terminal.

The resistors for your kit are supplied on plainly marked cards. Do not remove the resistors from the cards before you need them. Three types of resistors are used: Cylindrical carbon composition, modified cylindrical film, and ceramic encased wire-wound or carbon composition resistors. Five sizes of carbon composition resistors are supplied in this kit. In order of increasing sizes these are: $\frac{1}{3}$, $\frac{1}{2}$, 1, 2, and 7-watt units.

The value (resistance) is indicated by the first three color bands. The fourth band indicates the amount the resistance can vary from the stated value, with silver representing 10%, and gold, 5% tolerance. If the tolerance is important in a particular step, this will be specified.

Film type resistors look similar to composition types but are manufactured in a different way. This type is also marked with color bands and is used wherever its low-noise characteristics are needed. The wire-wound resistors generally have higher power ratings. The value of these resistors is marked in numbers right on the unit.

Variable resistors (controls) have their value and part number stamped on the case.

The step-by-step instructions must be followed exactly. DO NOT attempt to wire this kit from the pictorials or schematic diagram alone because a definite wiring sequence must be followed. Occasionally several parts are mounted or wired in a single step. Be sure to read the entire step before starting. A box is provided next to each step to check off the step after you have completed it.

THIS KIT MUST BE PROPERLY SOLDERED!

USE ENOUGH HEAT

This is the main idea of good soldering. Apply enough heat to the metal surfaces you are joining to make the solder spread freely, until the contour (shape) of the connection shows under the solder.

AN ELECTRONIC UNIT WILL NOT WORK . . . unless it is properly soldered. Read these instructions carefully to understand the basic ideas of good soldering.

Enough heat must be used so the solder can actually penetrate the metal surfaces, making an unbroken path over which electricity can travel. You are not using enough heat if the solder barely melts and forms a rounded ball of rough, flaky solder.

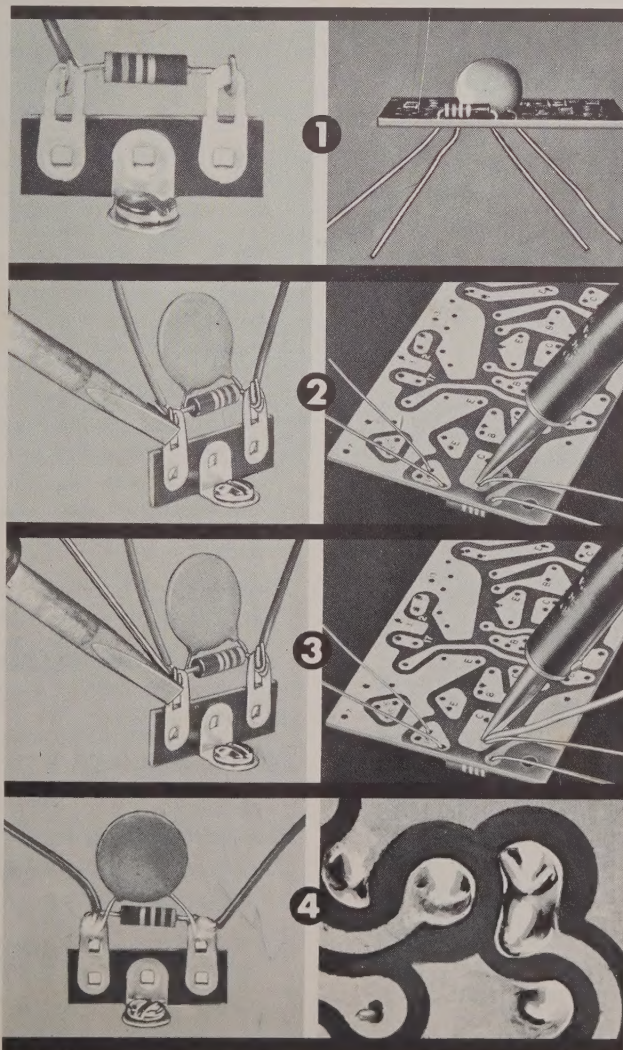
Use the Right Soldering Tool

A soldering iron in the 27-40 watt range is recommended. Any iron in this range with a clean, chisel-shaped tip will supply the correct amount of heat to make a good solder connection.

Keep the iron or gun tip brightly coated with solder. When necessary, wipe the hot tip clean with a cloth. If you are using an old tip, clean it before you start soldering.

Use Only Rosin Core Solder

We supply the right kind of solder (*rosin core solder*). Do not use any other kind of solder! Use of Acid Core Solder, Paste, or Irons Cleaned on a Sal Ammoniac Block will ruin any Electronic Unit and will Void the Guarantee.



HERE'S HOW TO DO IT . . .

1. Join bare metal to bare metal; insulation must be removed. Make good mechanical connections and keep resistor and capacitor leads as short as possible, unless otherwise specified.

2. Coat the tip of a hot iron with solder. Then **Firmly Press the Flat Side of the Tip** against the parts to be soldered together. Keep the iron there while you . . .

3. Apply the solder between the metal to be soldered and the iron tip. Use only enough solder to flow over all surfaces of the connection, and all wires in the connection. Remove the iron.

Do Not Move Parts Until the Solder Hardens. If you accidentally move the wires as the solder is hardening, apply your iron and reheat.

4. Compare your soldering with the pictures on this page. You have a good connection if your solder has flowed over all surfaces to be connected, following the shape of the surfaces. It should appear smooth and bright and all wires in the connection should be well-soldered.

You Have Not Used Enough Heat: If your connection is rough and flaky-looking, or if the solder has formed a round ball instead of spreading.

The difference between good soldering (enough heat) and poor soldering (not enough heat) is just a few extra seconds with a hot iron firmly applied. **REMEMBER, LARGER METAL SURFACES TAKE A LONGER TIME TO HEAT.**

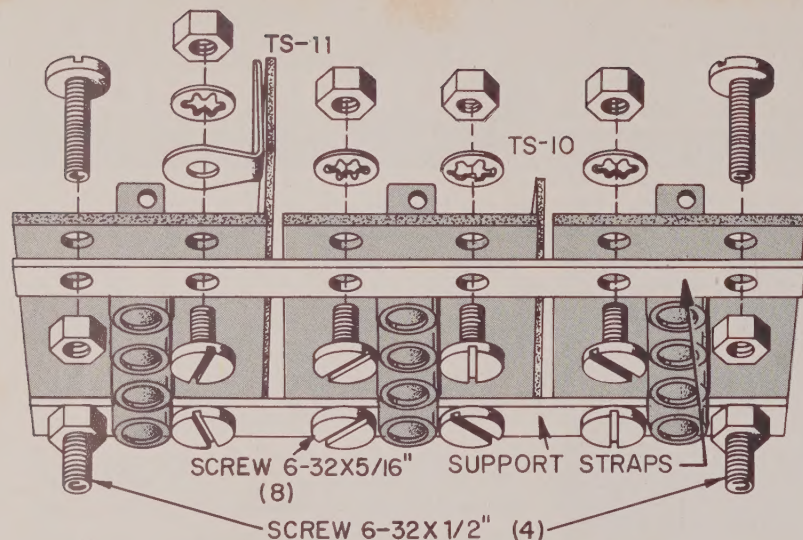


FIGURE 1. ASSEMBLY OF THE INPUT PANEL

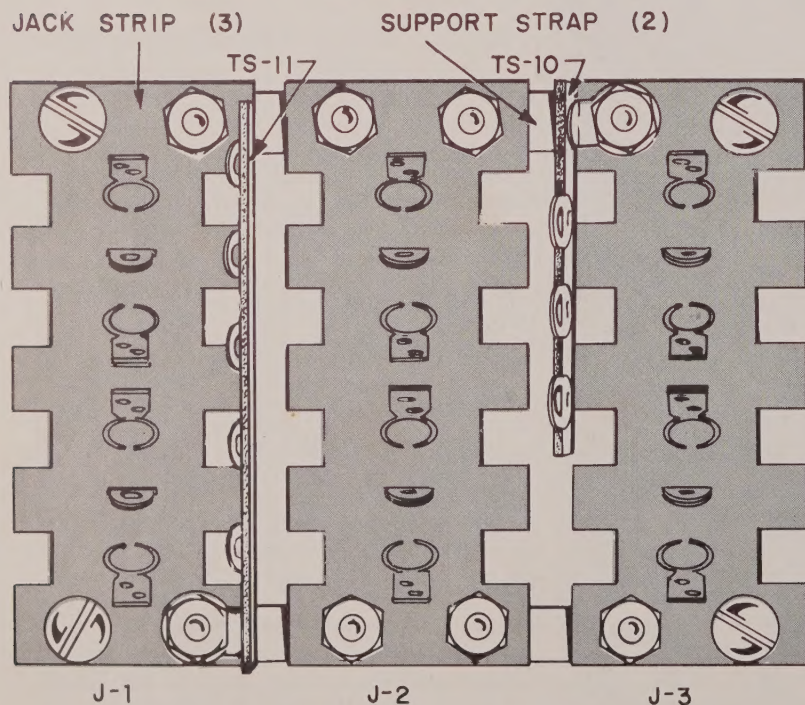


FIGURE 2. PARTS MOUNTED ON THE INPUT PANEL

INPUT PANEL ASSEMBLY

SEE FIGURES 1 AND 2.

- ✓ Mount three 4-jack strips, TS-10, a 3-terminal strip, and TS-11, a 5-terminal strip on the two jack support straps. Use eight 6-32 x $\frac{5}{16}$ " screws, four 6-32 x $\frac{1}{2}$ " screws, eight #6 lockwashers and twelve 6-32 nuts. Use the 6-32 x $\frac{1}{2}$ " screws at the four corners of the straps. Do not use lockwashers with the $\frac{1}{2}$ " screws. Always use the lockwasher directly under the nut, unless otherwise specified.

IMPORTANT INSTRUCTIONS

THE INSTRUCTION "CONNECT" MEANS: Connect the wire or lead to the given point. Make a firm mechanical connection, BUT DO NOT SOLDER AT THIS TIME. Later another wire (s) will be added to this point.

THE INSTRUCTION "SOLDER" MEANS: Connect the wire or lead to the given point and then solder the connection and all wires in it. If there is more than one wire in the connection, the number will be stated—for example (2 wires). After soldering a connection cut off any excess wire or lead ends as close to the terminal as possible.

FIRST WIRING OF THE INPUT PANEL

SEE FIGURE 3.

- ✓ R-1, 150K resistor (brown, green, yellow). Connect one lead to terminal 1 of J-2. Connect the other lead to terminal 1 of TS-11.

IMPORTANT! Resistor and capacitor leads must be as short as possible. For proper fit of the input panel, make sure that resistors are positioned *no higher than the terminal strips*.

- ✓ R-4, 27K resistor (red, violet, orange). Push one lead through terminal 2 of TS-11 and connect it to terminal 2 of J-2. Connect the other lead to terminal 1 of TS-11. Solder terminal 2 of TS-11.
- ✓ R-6, 150K resistor (brown, green, yellow). Connect one lead to terminal 3 of J-2. Connect the other lead to terminal 3 of TS-11.

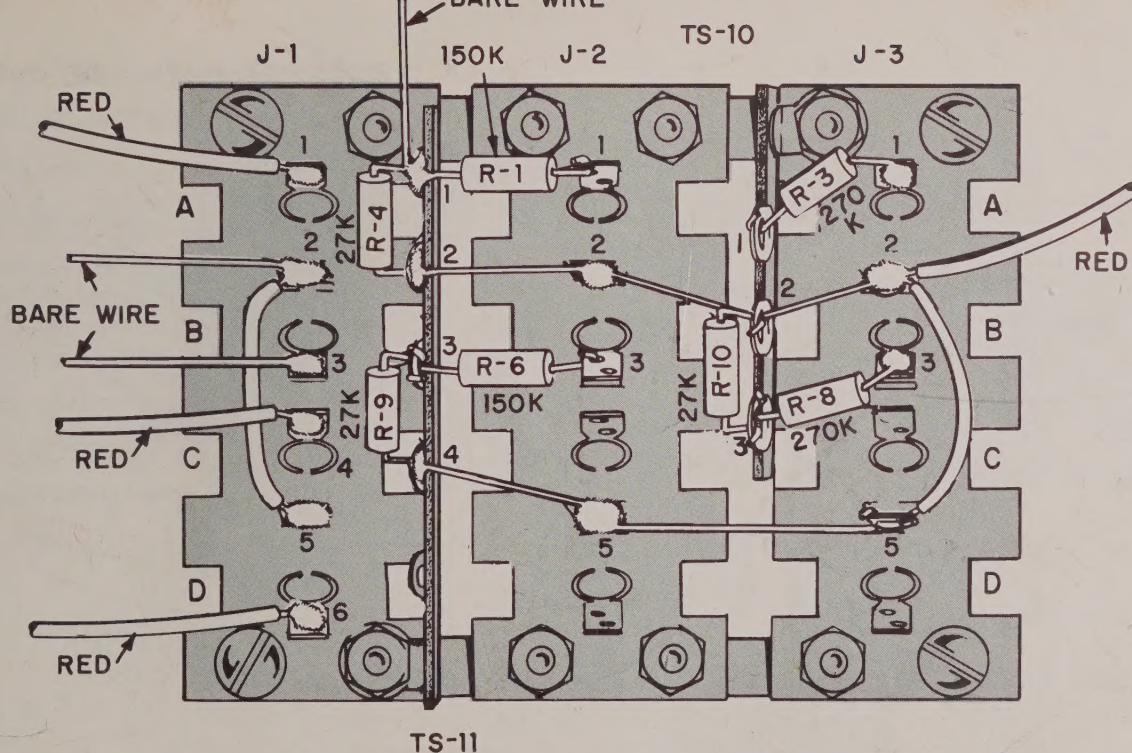


FIGURE 3. FIRST WIRING OF THE INPUT PANEL

- ✓ R-9, 27K resistor (red, violet, orange). Push one lead through terminal 4 of TS-11 and connect it to terminal 5 of J-2. Connect the other lead to terminal 3 of TS-11. Solder terminal 4 of TS-11.

Precut wire has been supplied with your kit; these wires have been pre-stripped for your convenience. Use only the color wire called for in each step. When a specific wire length is stated, be sure to measure it so that the proper wire will be installed. Cut bare wire and tubing from the lengths supplied.

- ✓ 1½" bare wire. Solder one end to terminal 1 of TS-11 (3 wires).
- ✓ 2" red wire. Solder one end to terminal 1 of J-1.
- ✓ 1¼" bare wire. Solder one end to terminal 3 of J-1.
- ✓ 2" red wire. Connect one end to terminal 2 of J-1. Solder the other end to terminal 5 of J-1.
- ✓ 1½" bare wire. Solder one end to terminal 2 of J-1 (2 wires).

Terminal 2 of J-1 is a double terminal. Both halves of double terminals must be well soldered.

- ✓ 2" red wire. Solder one end to terminal 4 of J-1.
- ✓ 2" red wire. Solder one end to terminal 6 of J-1.
- ✓ 1½" bare wire. Pass one end through the hole in terminal 2 of TS-10 and connect it to terminal 2 of J-3. Solder the other end to terminal 2 of J-2 (2 wires).
- ✓ 1½" bare wire. Solder one end to terminal 5 of J-2 (2 wires). Connect the other end to terminal 5 of J-3.
- ✓ 2" red wire. Connect one end to terminal 2 of J-3. Connect the other end to terminal 5 of J-3.
- ✓ 2" red wire. Solder one end to terminal 2 of J-3 (3 wires).
- ✓ R-3, 270K resistor (red, violet, yellow). Solder one lead to terminal 1 of J-3. Connect the other end to terminal 1 of TS-10.
- ✓ R-8, 270K resistor (red, violet, yellow). Solder one end to terminal 3 of J-3. Connect the other end to terminal 3 of TS-10.
- ✓ R-10, 27K resistor (red, violet, orange). Connect one end to terminal 2 of TS-10. Connect the other end to terminal 3 of TS-10.

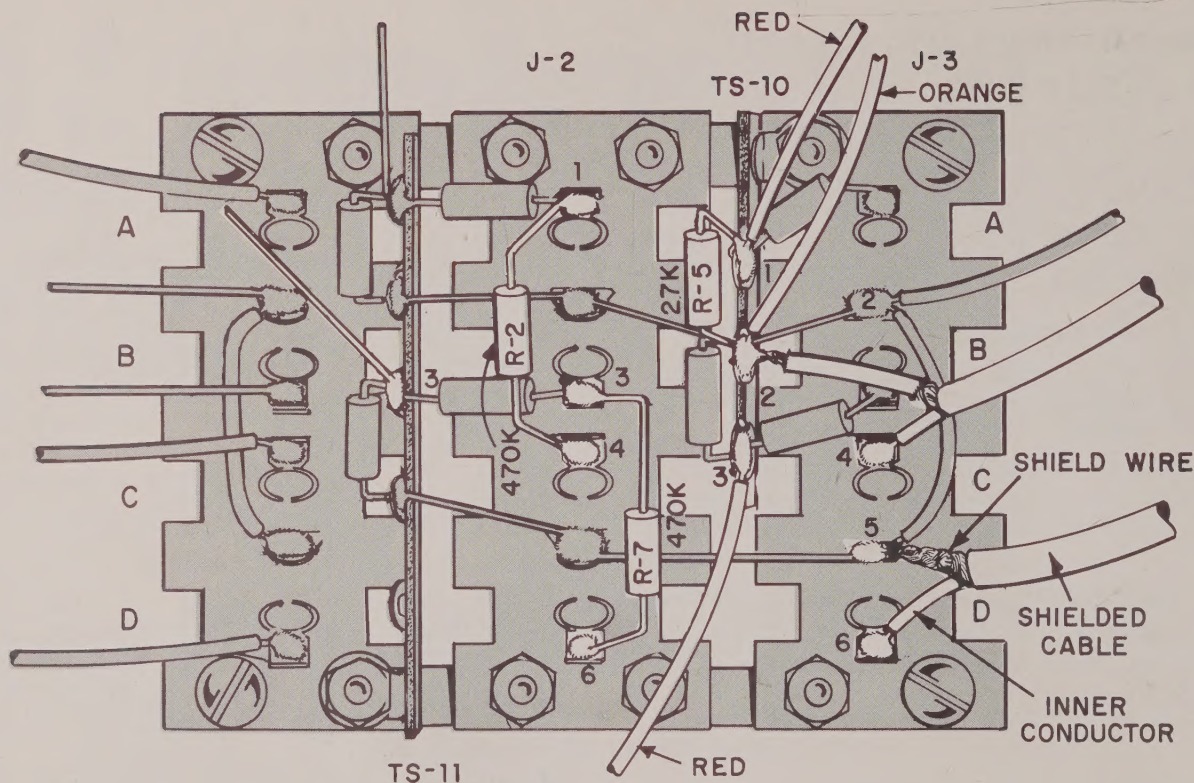


FIGURE 4
SECOND WIRING,
INPUT PANEL

SECOND WIRING OF THE INPUT PANEL

SEE FIGURE 4.

- ✓ 1½" bare wire. Solder one end to terminal 3 of TS-11 (3 wires).
- ✓ R-2, 470K resistor (yellow, violet, yellow). Solder one lead to terminal 1 of J-2 (2 wires). Solder the other lead to terminal 4 of J-2.
- ✓ R-7, 470K resistor (yellow, violet, yellow). Solder one lead to terminal 3 of J-2 (2 wires). Solder the other lead to terminal 6 of J-2.
- ✓ 2" red wire. Solder one end to terminal 3 of TS-10 (3 wires).
- ✓ 2" red wire. Connect one end to terminal 1 of TS-10.
- ✓ R-5, 27K resistor (red, violet, orange). Solder one lead to terminal 1 of TS-10 (3 wires). Connect the other lead to terminal 2 of TS-10.

- ✓ 3" orange wire. Connect one end to terminal 2 of TS-10.
- ✓ 10" red shielded cable. Twist the shield strands together and solder the inner wire to terminal 4 of J-3. Slip a ½" length of small black tubing over the shield wire and solder it to terminal 2 of TS-10 (5 wires). Be sure all wires are soldered.
- ✓ 7" gray shielded cable. Cut the shield wires to ½". Twist the shield strands together and solder the shield wire to terminal 5 of J-3 (3 wires). Solder the inner wire to terminal 6 of J-3.
- ✓ Please go back and check your work, step by step. Compare your wiring of the input panel with the illustration to be sure that your wiring is correct. *Carefully inspect* all soldered terminals to be sure that solder has flowed over *all wires* in the terminal.

POWER SUPPLY SHIELD SUB-ASSEMBLY

SEE FIGURE 5.

- ✓ Power supply shield. Install three 1/2" rubber grommets.
- ✓ 2 spade bolts. Attach to the shield with a 6-32x5/16" screw, lockwasher and nut. Notice that the shoulder is away from the shield. Mount the second spade bolt (shown behind C-64) in the same manner on the outside of the "L".
- ✓ C-67, 1000 μ f electrolytic capacitor. Slip plastic clamp over the capacitor and mount it and a metal cable clamp to the shield with a 6-32 x 1/2" screw, lock washer and nut. Push wires from C-67 through the large grommet on the shield.
- ✓ C-66, 2000 μ f electrolytic capacitor. Mount with a 6-32 x 5/16" screw, lockwasher and nut.
- ✓ C-64, 2000 μ f electrolytic capacitor. Mount in the same manner as C-66.
- ✓ Clip nut. Install so the smooth side of the clip faces as shown. Set this sub-assembly aside; it will be used later.

MOUNTING PARTS ON THE POWER SUPPLY BRACKET

SEE FIGURE 6.

- ✓ Power supply bracket. Slip two clip nuts over the lip of the bracket. Be sure that the smooth side faces out, and the clips are centered over the holes in the bracket.
- ✓ TS-7, an 8-terminal strip. Mount with a 6-32 x 5/16" screw, lockwasher and nut. Unless otherwise specified lockwashers are used directly under the nut.
- ✓ TS-6, an 8-terminal strip. Mount with a 6-32 x 5/16" screw, lockwasher and nut.
- ✓ Two fuse holders (chassis mount type). Install each with a 6-32 x 5/16" screw, lockwasher and nut.

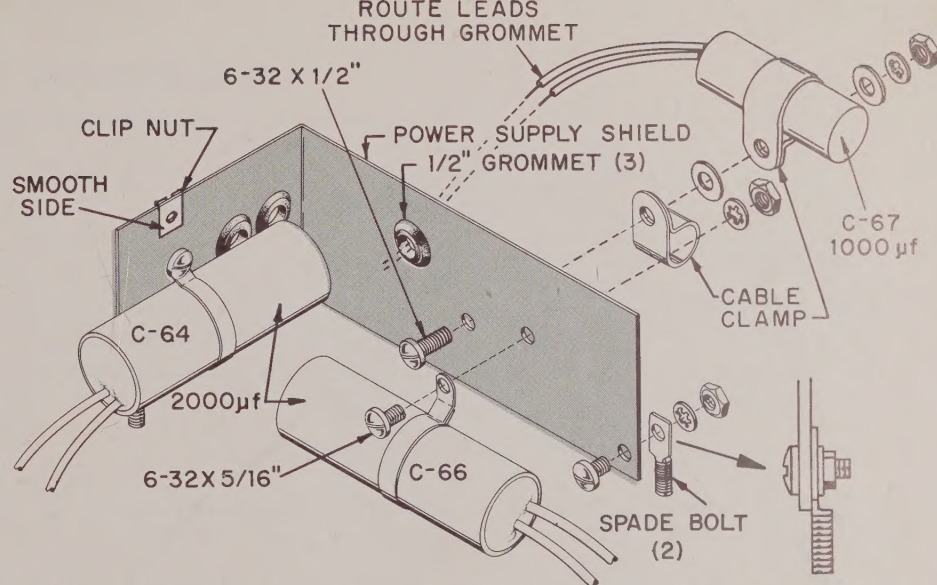


FIGURE 5. ASSEMBLY OF THE POWER SUPPLY SHIELD

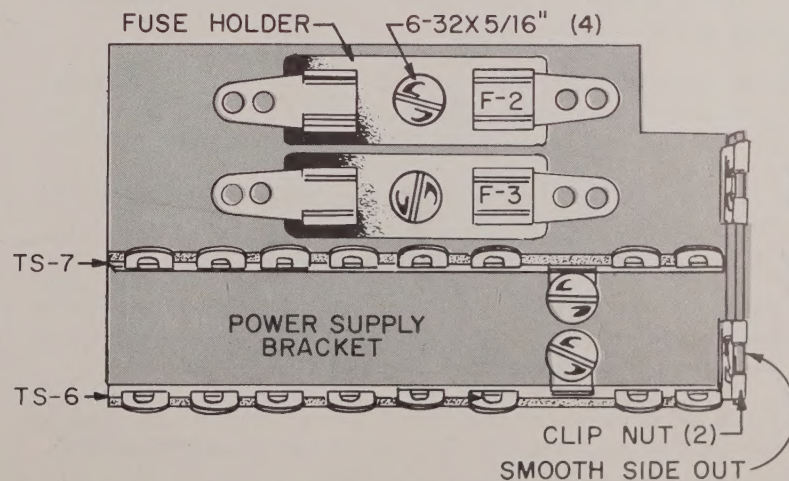


FIGURE 6. THE POWER SUPPLY BRACKET ASSEMBLY

PRE-WIRING THE POWER SUPPLY BRACKET

SEE FIGURE 7.

- ☒ 1 1/4" bare wire. Connect one end to terminal 1 of TS-6. Connect the other end to terminal 1 of TS-7. Check to see that the terminal 1 end of TS-6 is resting on the bracket; it must not be bent down along the edge of the bracket.

NOTE: silicon diodes must be installed **EXACTLY** as shown.

- ☒ CR-1, silicon rectifier. Connect the lead from the marked end to terminal 2 of TS-7. Connect the other lead to terminal 2 of TS-6.
- ☒ CR-2, silicon rectifier. Connect the lead from the marked end to terminal 3 of TS-6. Push the other lead through terminal 3 of TS-7 and connect it to terminal 2 of TS-7. Solder terminal 3 of TS-7.
- ☒ CR-4, silicon rectifier. Push the lead from the marked end through terminal 4 of TS-6 and connect it to terminal 3 of TS-6. Connect the other lead to terminal 4 of TS-7.
- ☒ CR-3, silicon rectifier. Push the lead from the marked end through terminal 5 of TS-7 and connect it to terminal 4 of TS-7. Solder terminal 5 of TS-7. Connect the other lead to terminal 5 of TS-6.
- ☒ 2" red wire. Connect one end to terminal 2 of TS-6. Connect the other end to terminal 5 of TS-6.
- ☒ R-106, 330 Ω resistor (orange, orange, brown). Push one lead through terminal 6 of TS-6. Slip a 1/2" length of small tubing over this end and connect it to terminal 7 of TS-6. Solder terminal 6 of TS-6. Connect the other lead to terminal 6 of TS-7.
- ☒ R-107, 150 Ω resistor (brown, green, brown). Connect one lead to terminal 7 of TS-6. Connect the other lead to terminal 7 of TS-7.
- ☒ R-104, 150 Ω resistor (brown, green, brown). Connect one lead to terminal 8 of TS-6. Connect the other lead to terminal 8 of TS-7.

- ☒ 4" yellow wire. Solder one end to terminal 7 of TS-6 (3 wires). Connect the other end to terminal 1 of F-3.
- ☒ Green wire. Solder one end to terminal 8 of TS-6 (2 wires). Connect the other end to terminal 1 of F-2.
- ☒ Carefully check your work for correct wiring and good solder connections. Then set this assembly aside; it will be used later.

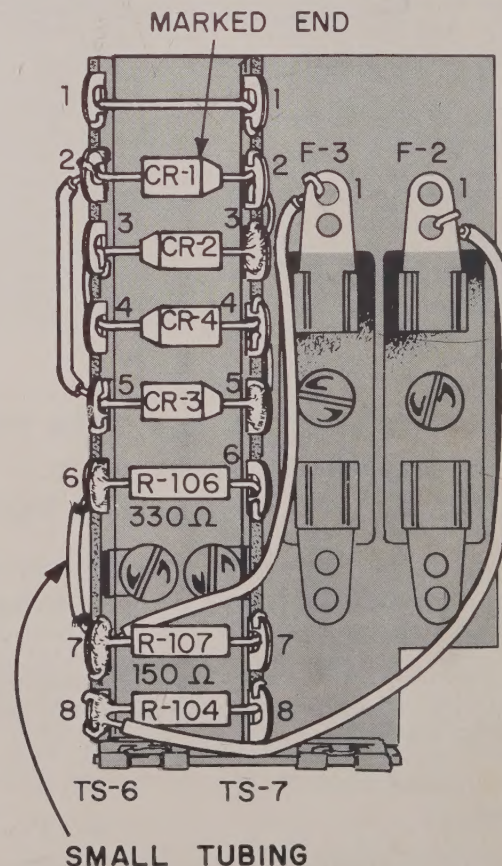


FIGURE 7. POWER SUPPLY BRACKET WIRING

PRE-WIRING THE SELECTOR SWITCH

SEE FIGURE 8.

- ☒ Position the switch with the locating tab as shown.

CAUTION: When you solder switch terminals, do not apply so much solder that it runs down the terminal past the rivet. Solder allowed to flow past the rivet can cause permanent damage to the switch.

- ☒ Violet wire. Solder one end to terminal 1 of wafer A. Wafer A is the one closest to the shaft.
- ☒ Blue wire. Solder one end to terminal 2 of wafer A.
- ☒ 2" red wire. Solder one end to terminal 3 of wafer A.
- ☒ Gray wire. Solder one end to terminal 1 of wafer B.
- ☒ 7" yellow wire. Solder one end to terminal 2 of wafer B.
- ☒ Green wire. Solder one end to terminal 3 of wafer B.

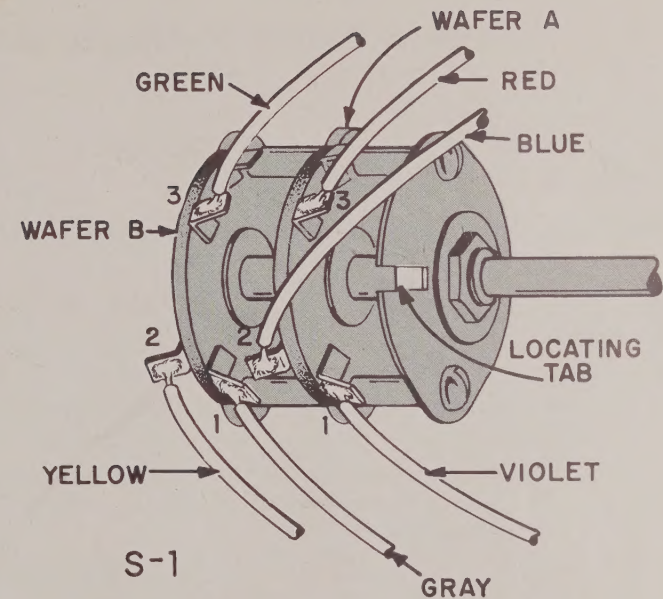


FIGURE 8. SELECTOR SWITCH, LOCATING TAB SIDE

SEE FIGURE 9.

- ☒ Turn the switch over, position the locating tab as shown.
- ☒ 3/4" bare wire. Connect one end to terminal 6 of wafer A. Connect the other end to terminal 6 of wafer B. Notice that the wire connects to both lugs of each terminal.
- ☒ 3" orange wire. Solder one end to terminal 6 (both lugs) of wafer A (2 wires).
- ☒ Green wire. Solder one end to terminal 7 of wafer A.
- ☒ 4" yellow wire. Solder one end to terminal 8 of wafer A.
- ☒ Violet wire. Solder one end to terminal 7 of wafer B.
- ☒ Blue wire. Solder one end to terminal 8 of wafer B.
- ☒ Inspect your switch. Trim any excess wire close to the terminal.
- ☒ Set the switch aside; it will be used later.

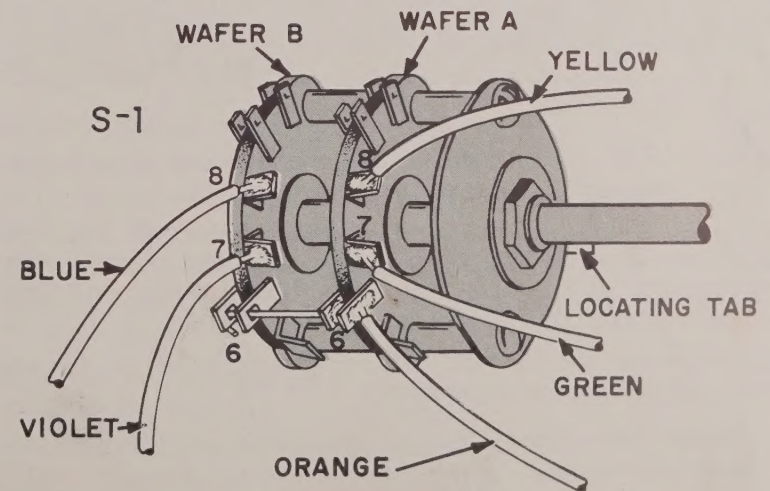


FIGURE 9. SELECTOR SWITCH PRE-WIRING

MOUNTING PARTS ON THE LARGE CIRCUIT BOARD

SEE FIGURES 10 AND 11.

Supplied with your amplifier kit are two printed circuit boards. The larger of the two boards will be wired first.

- ☒ Examine the large circuit board. Notice that it has two different sides: a component side, on which are printed outlines of the parts; and a copper foil side, on which is etched the wiring pattern. Mount all parts on the component side of the board. Solder all parts to the foil side of the board.

NOTE: the foil side of the circuit board will have a blue appearance. This is caused by a solder resistant coating that has been applied to your board to help avoid solder "shorts".

- ☒ Small transistor socket. On the component side of the board, insert the socket leads into the holes for TR-6. Turn the board over, resting it on the socket to hold the socket in place. Solder the three leads carefully. Use only enough solder to cover the base of the lead and the hole. Do not allow solder to flow to the next hole in the "island".

CAUTION: There are many closely spaced strips in the wiring pattern. When you solder parts to the board, be careful not to short together separate strips of foil.

- ☒ Eleven small transistor sockets. Insert in the board one at a time; then solder each in the same manner as TR-6.

Resistors and capacitors will be mounted next. **ELECTROLYTIC CAPACITORS MUST BE MOUNTED CORRECTLY, WITH THE + END POSITIONED AS ILLUSTRATED OR THE AMPLIFIER WILL NOT WORK AND COSTLY PARTS MAY BE DAMAGED.**

For convenience, the following parts are mounted in groups, then soldered. Use this method for mounting:

1. **INSERT THE LEADS** of the parts through the holes. Place the part over its outline on the board, close to the board surface.
2. **THEN BEND THE LEADS AT A SLIGHT ANGLE** on the foil side of the board, so that the part is held securely in place.

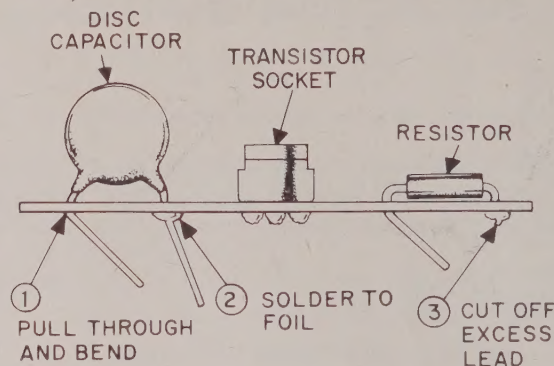


FIGURE 10

SEE FIGURE 11.

Mount the following group of parts:

- ☒ C-41 .01 μ f disc capacitor.
- ☒ R-69 15K resistor (brown, green, orange). Notice that resistors are easy to mount if the leads are first bent close to the body.
- ☒ C-49 10 μ f, 15-volt electrolytic capacitor. Position the end marked with a + as shown.
- ☒ C-38 10 μ f, 15-volt electrolytic capacitor. Position the end marked with a + as shown.

☒ Now turn the board over and solder each component as follows:

1. **SOLDER EACH LEAD** of each part, only at the hole in the metal foil where the lead comes through. Be sure that you heat the connection until the solder runs and spreads around the lead and hole.
2. **CUT OFF EACH LEAD** as close as possible to the board. Inspect each soldered lead to be sure that it does not short across to an adjacent foil strip.

Mount the following group of parts:

- ☒ R-62 150 Ω resistor (brown, green, brown).
- ☒ R-61 4.7K resistor (yellow, violet, red).
- ☒ C-36 10 μ f, 15-volt electrolytic capacitor. Position the end marked + as shown.
- ☒ C-26 10 μ f, 15-volt electrolytic capacitor. Position the end marked + as shown.

Carefully solder each lead of the parts just mounted; then cut off the lead as close to the board as possible.

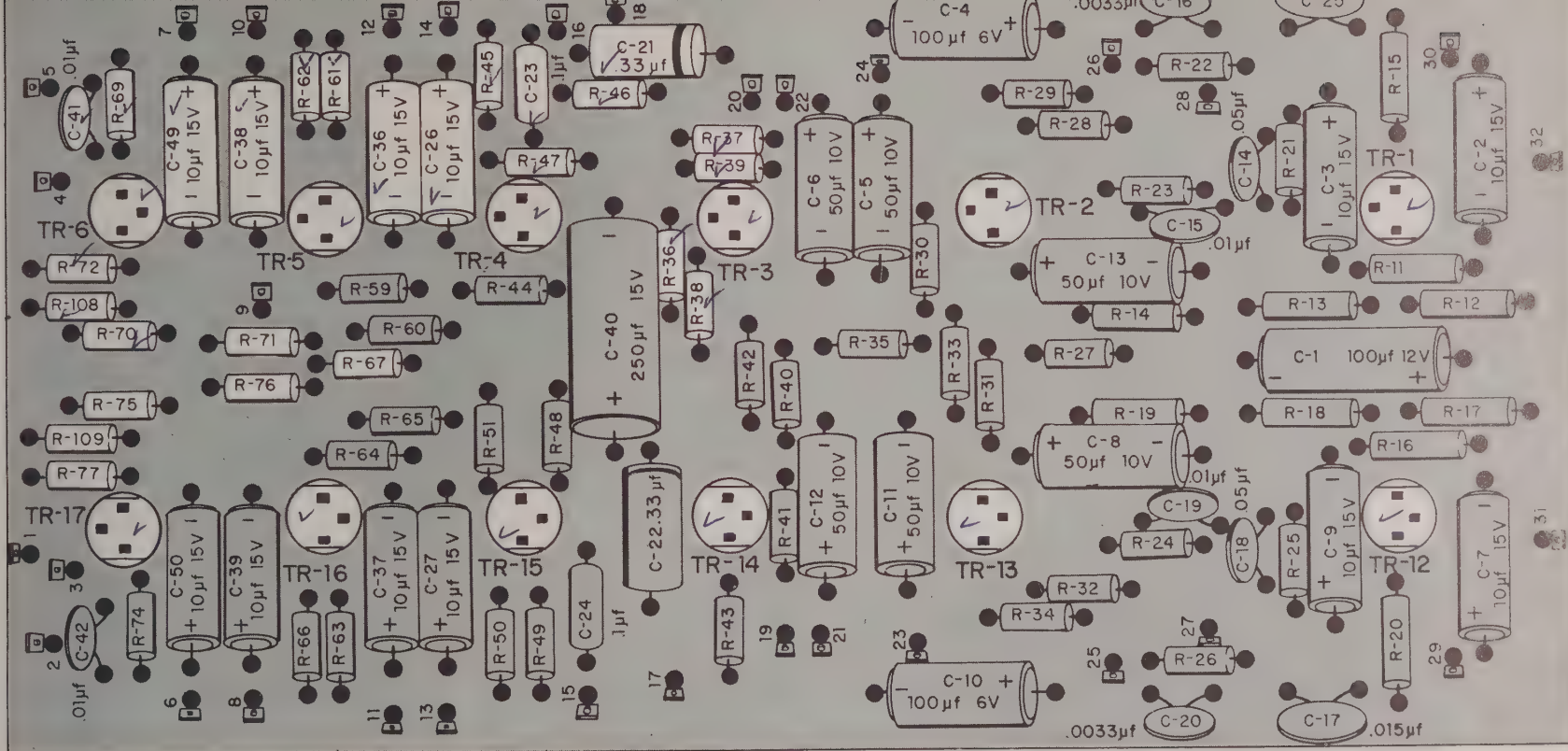


FIGURE 11. LARGE PRINTED CIRCUIT BOARD (FIRST VIEW)

Mount the next group of parts:

- ☒ R-45 1.5 meg resistor (brown, green, green).
- ☒ R-47 1K resistor (brown, black, red).
- ☒ C-23 .1 μ f mylar capacitor.
- ☒ C-21 .33 mylar capacitor. C-21 may appear slightly different than shown.
- ☒ R-46 4.7K resistor (yellow, violet, red).

Carefully solder each lead of the parts just mounted. Cut off the leads as close as possible to the board.

Mount the next group of parts:

- ☒ R-39 680 Ω resistor (blue, gray, brown).
- ☒ R-37 100K resistor (brown, black, yellow).
- ☒ R-38 10K resistor (brown, black, orange).
- ☒ R-36 680K resistor (blue, gray, yellow).
- ☒ Carefully solder each lead of the parts just mounted. Cut off the leads as close as possible to the board.

Mount the next group of parts:

- ☒ R-72 330 Ω resistor (orange, orange, brown).
- ☒ R-108 22K resistor (red, red, orange).
- ☒ R-70 470K resistor (yellow, violet, yellow).
- ☒ R-77 330 Ω resistor (orange, orange, brown).

Carefully solder each lead of the parts just mounted. Cut off the leads as close as possible to the board.

Mount the next group of parts:

- ☒ R-109 22K resistor (red, red, orange).
- ☒ R-75 470K resistor (yellow, violet, yellow).
- ☒ R-71 15K resistor (brown, green, orange).
- ☒ R-76 15K resistor (brown, green, orange).
- ☒ R-67 470 Ω resistor (yellow, violet, brown).

☒ Carefully solder each lead of the parts just mounted; then cut off the lead as close to the board as possible.

MOUNTING PARTS ON THE LARGE PRINTED CIRCUIT BOARD—Continued

SEE FIGURE 12.

Mount the next group of parts:

- ☒ R-60 2.2K resistor (red, red, red).
- ☒ R-59 39K resistor (orange, white, orange).
- ☒ R-44 330K resistor (orange, orange, yellow).
- ☒ R-65 2.2K resistor (red, red, red).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-64 39K resistor (orange, white, orange).
- ☒ R-51 1K resistor (brown, black, red).
- ☒ R-48 330K resistor (orange, orange, yellow).
- ☒ C-40 250 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ C-27 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-42 .01 μ f disc capacitor.
- ☒ R-74 15K resistor (brown, green, orange).
- ☒ C-50 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ C-39 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-66 150 Ω resistor (brown, green, brown).
- ☒ R-63 4.7K resistor (yellow, violet, red).
- ☒ C-37 10 μ f, 15-volt electrolytic capacitor. Position the end marked with a + where shown.
- ☒ R-50 4.7K resistor (yellow, violet, red).
- ☒ R-49 1.5 meg resistor (brown, green, green).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-24 .1 μ f mylar capacitor.
- ☒ R-43 680 Ω resistor (blue, gray, brown).
- ☒ C-22 .33 μ f mylar capacitor. C-22 may appear different than shown.
- ☒ R-41 100K resistor (brown, black, yellow).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-42 10K resistor (brown, black, orange).
- ☒ R-40 680K resistor (blue, gray, yellow).
- ☒ C-6 50 μ f, 10-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ C-5 50 μ f, 10-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-12 50 μ f, 10-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ C-11 50 μ f, 10-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ R-35 6.8K resistor (blue, gray, red).
- ☒ R-33 6.8K resistor (blue, gray, red).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-30 6.8K resistor (blue, gray, red).
- ☒ R-31 100K resistor (brown, black, yellow).
- ☒ R-27 100K resistor (brown, black, yellow).
- ☒ R-19 20K, 5% film resistor (red, black, orange).
- ☒ C-8 50 μ f, 10-volt electrolytic capacitor.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

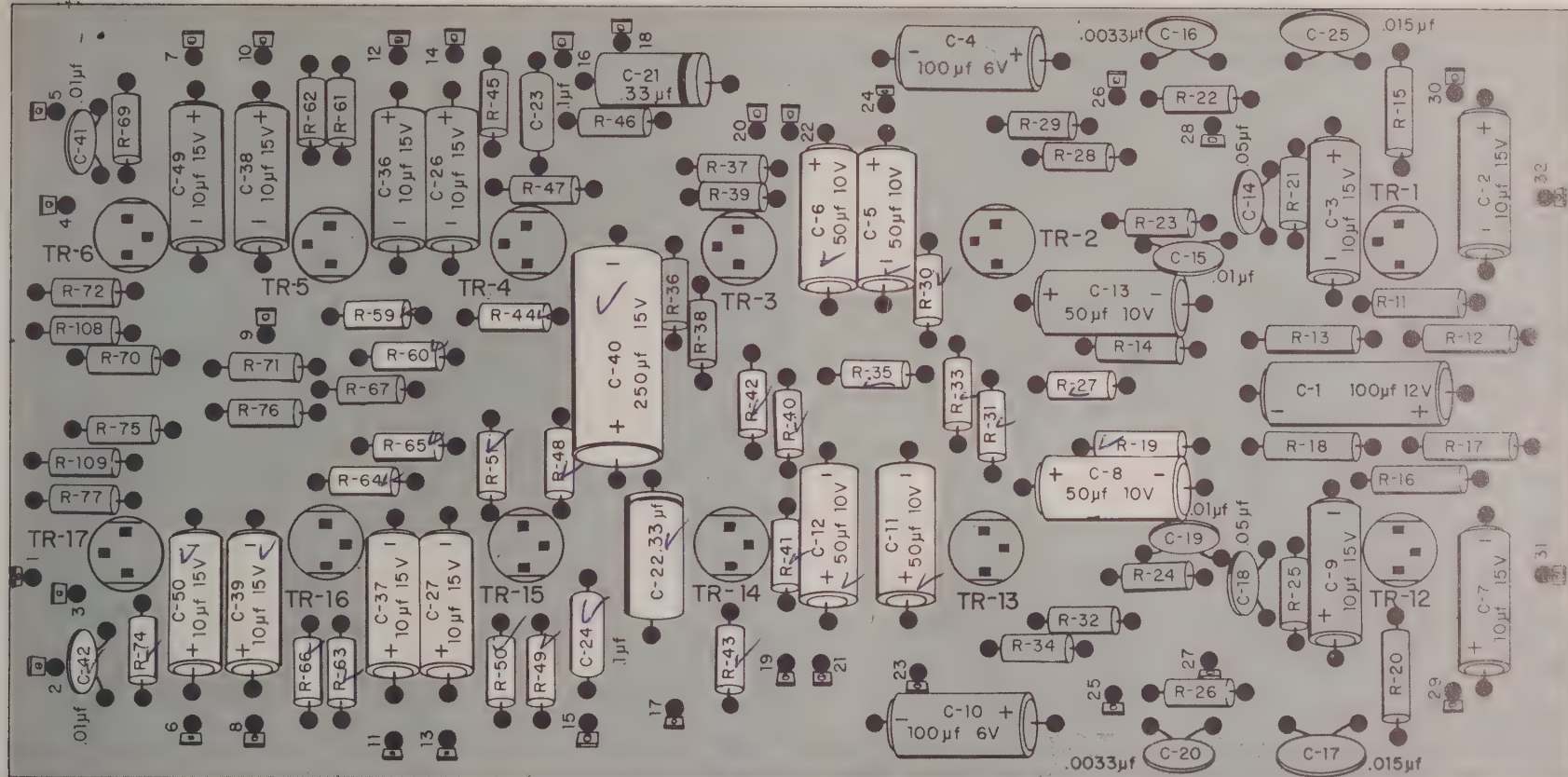
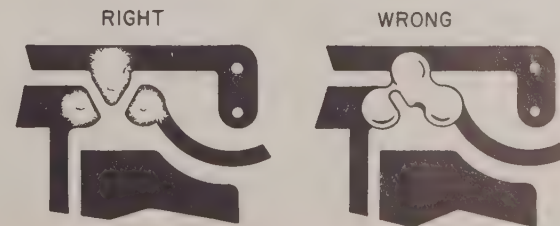


FIGURE 12. LARGE PRINTED CIRCUIT BOARD (SECOND VIEW)

INSPECT YOUR SOLDERING. Solder must not bridge across from one foil strip to another foil strip. Below is a correctly soldered foil strip and a "WRONG" picture with 2 solder bridges or short circuits to other foil strips.

To correct a solder "bridge" or shorted foil strips, hold the board foil side down. Place the hot tip of your iron against the connection and allow the solder to run back onto the tip. Use your cutters to remove any excess wire that may be shorting across the two strips.



MOUNTING PARTS ON THE LARGE PRINTED CIRCUIT BOARD—Continued

SEE FIGURE 13.

Mount the next group of parts:

- ☒ C-4 100 μ f, 6-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ R-29 330 Ω resistor (orange, orange, brown).
- ☒ R-28 4.7K resistor (yellow, violet, red).
- ☒ C-16 .0033 μ f disc capacitor (may be marked 3300 μ f).
- ☒ R-23 7.5K, 5% resistor (violet, green, red).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-15 .01 μ f disc capacitor.
- ☒ C-14 .05 μ f disc capacitor.
- ☒ C-13 50 μ f 10-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ R-14 20K, 5% film resistor (red, black, orange).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-22 3.9K resistor (orange, white, red).
- ☒ C-25 .015 μ f disc capacitor.
- ☒ R-15 820 Ω , 5% film resistor (gray, red, brown).
- ☒ R-21 150K resistor (brown, green, yellow).
- ☒ C-3 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-2 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ R-13 100K, 5% film resistor (brown, black, yellow).
- ☒ R-11 10K, 5% film resistor (brown, black, orange).
- ☒ R-12 2.2K, film resistor (red, red, red).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-1 100 μ f, 12-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ R-18 100K, 5% film resistor (brown, black, yellow).
- ☒ R-17 2.2K, film resistor (red, red, red).
- ☒ R-16 10K, 5% film resistor (brown, black, orange).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-19 .01 μ f disc capacitor.
- ☒ C-18 .05 μ f disc capacitor.
- ☒ R-25 150K resistor (brown, green, yellow).
- ☒ C-9 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-24 7.5K, 5% resistor (violet, green, red).
- ☒ R-32 4.7K resistor (yellow, violet, red).
- ☒ R-34 330 Ω resistor (orange, orange, brown).
- ☒ C-10 100 μ f, 6-volt electrolytic capacitor. Position the end marked + where shown.
- ☐ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the last group of parts:

- ☒ R-26 3.9K resistor (orange, white, red).
- ☒ C-20 .0033 μ f disc capacitor (may be marked 3300 μ f).
- ☒ C-17 .015 μ f disc capacitor.
- ☒ R-20 820 Ω , 5% film resistor (gray, red, brown).
- ☐ C-7 10 μ f, 15-volt electrolytic capacitor. Position the end marked + where shown.
- ☐ Solder each lead; then cut off the excess lead length.
- ☐ Set the board aside; it will be used later.

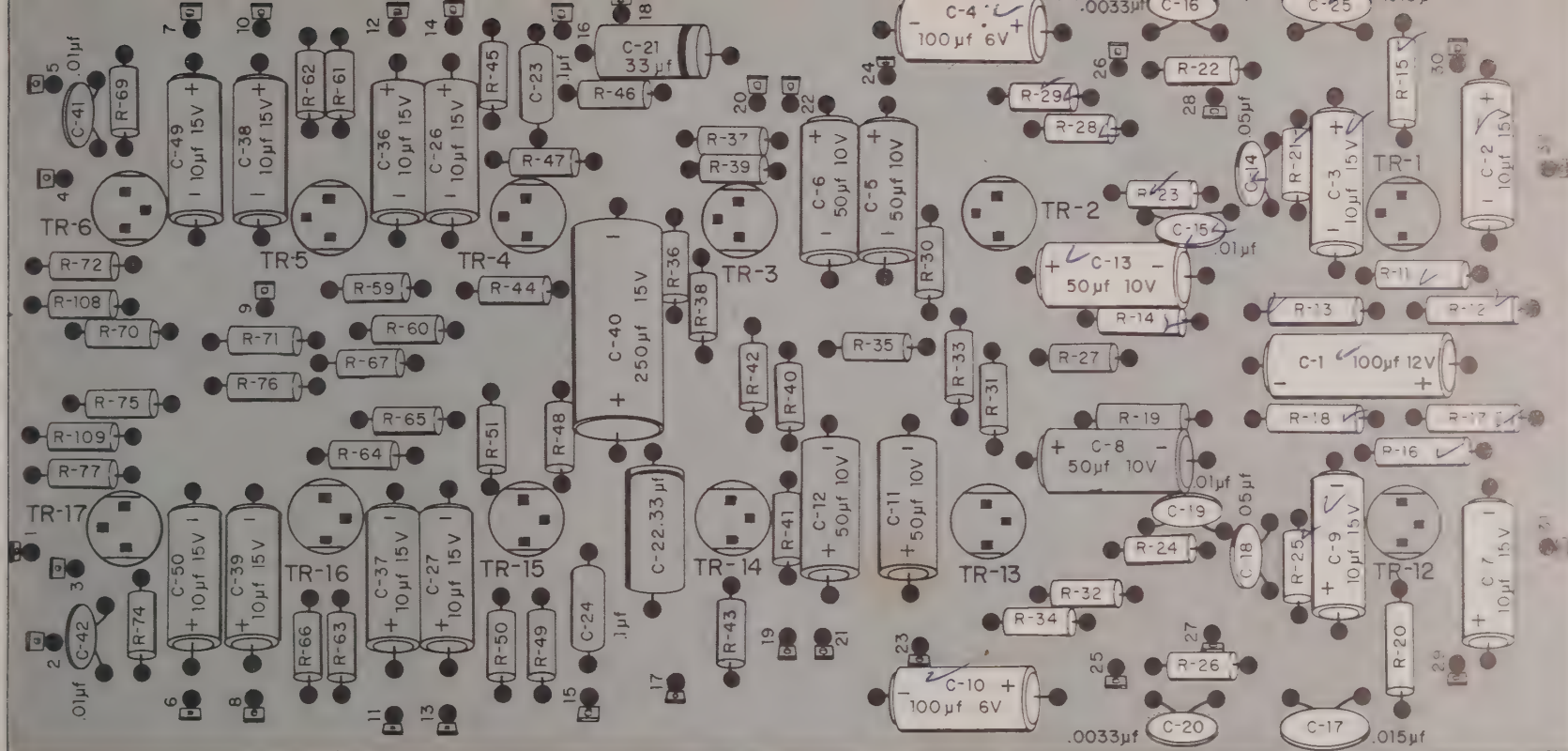


FIGURE 13. LARGE PRINTED CIRCUIT BOARD (THIRD VIEW)



Inspect the finished board for possible solder bridges from one foil path to another, and poor solder joints. If a connection is not smooth and shiny, reheat it and add a small amount of solder. When you are satisfied that the board is OK, set it aside where it can not be damaged.

Take a rest! Remember a tired builder more easily makes a mistake.



MOUNTING PARTS ON THE SMALL CIRCUIT BOARD

SEE FIGURE 14.

- ☒ Small transistor socket. On the component side of the board, insert socket leads into the holes for TR-7. Turn the board over, resting it on the socket to hold the socket in place. Solder the three leads carefully. Use only enough solder to cover the base of the lead and the hole. Do not allow solder to flow to the next hole in the "island".
- ☒ Three small transistor sockets, for TR-8, TR-18 and TR-19. Insert and solder in the board as above.

Mount the following group of parts:

- ☒ R-99 1.2K 1-watt resistor (brown, red, red). Slip $\frac{3}{8}$ " small tubing over each lead.
- ☒ R-96 150 Ω 2-watt resistor (brown, green, brown).
- ☒ R-97 150 Ω 2-watt resistor (brown, green, brown).
- ☒ R-101 1.2K 1-watt resistor (brown, red, red). Slip $\frac{3}{8}$ " small tubing over each lead.
- ☒ C-59 50 μ f, 25-volt electrolytic capacitor. Position the end marked + as shown.
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-60 50 μ f, 25-volt electrolytic capacitor. Position the end marked + as shown.
- ☒ R-92 5.1K, 5% resistor (green, brown, red).
- ☒ C-61 270 μ f disc capacitor.
- ☒ R-81 510 Ω , 5% resistor (green, brown, brown).
- ☒ Solder each lead of the parts just mounted. Cut off excess lead.

Mount the next group of parts:

- ☒ R-82 1.5K resistor (brown, green, red).
- ☒ R-79 22K resistor (red, red, orange).
- ☒ C-51 10 μ f, 25-volt electrolytic capacitor. Position the end marked + as shown.
- ☒ R-78 150K resistor (brown, green, yellow).
- ☒ C-53 25 μ f, 10-volt electrolytic capacitor. Position the end marked + as shown.
- ☒ R-84 1K resistor (brown, black, red).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ R-89 10K resistor (brown, black, orange).

- ☒ R-93 5.1K, 5% resistor (green, brown, red).
- ☒ C-62 270 μ f disc capacitor.
- ☒ R-88 510 Ω , 5% resistor (green, brown, brown).
- ☒ C-54 25 μ f, 10-volt electrolytic capacitor. Position the end marked + as shown.
- ☒ R-87 1.5K resistor (brown, green, red).
- ☒ R-90 1K resistor (brown, black, red).
- ☒ Solder each lead of the parts just mounted; cut off the excess lead.

Mount the next group of parts:

- ☒ C-52 10 μ f, 25-volt electrolytic capacitor. Bend down the solder lug protruding through the stenciled outline. Position the end marked + as shown.
- ☒ R-86 150K resistor (brown, green, yellow).
- ☒ R-85 22K resistor (red, red, orange).
- ☒ R-83 3.3K resistor (orange, orange, red).
- ☒ Solder each lead of the parts just mounted. Cut off excess lead.

Mount the next group of parts:

- ☒ R-80 10K resistor (brown, black, orange).
- ☒ C-55 270 μ f disc capacitor.
- ☒ R-91 3.3K resistor (orange, orange, red).
- ☒ C-56 270 μ f disc capacitor.
- ☐ C-57 200 μ f, 25-volt electrolytic capacitor. Bend down the solder lug protruding through the stenciled outline. Position the end marked + where shown.
- ☒ C-58 200 μ f, 25-volt electrolytic capacitor. Position the end marked + where shown.
- ☒ Solder each lead of the parts just mounted; then cut off the excess leads.
- ☒ Inspect the finished board for possible solder bridges from one foil path to another and poor solder joints. If a connection is not smooth and shiny, reheat it and add a small amount of fresh solder. When you are satisfied that the board is OK, set it aside where it cannot be damaged.

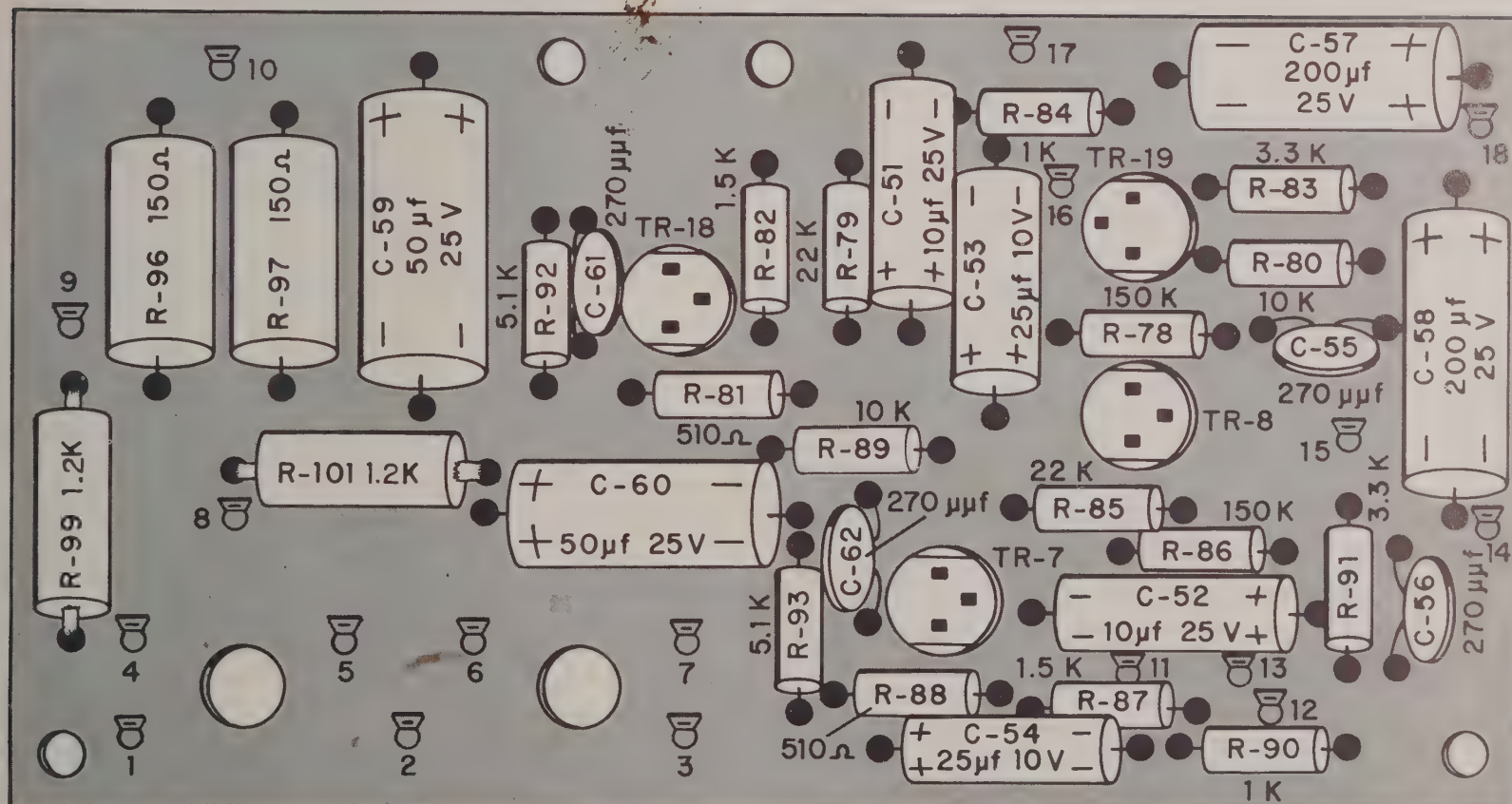


FIGURE 14. THE SMALL CIRCUIT BOARD

MOUNTING PARTS ON THE CHASSIS

SEE FIGURE 15.

- ✓ 4 Feet and 4 thread-cutting screws. Mount each foot with a thread cutting screw in the locations indicated in Figure 16.

NOTE: the side of the chassis that the feet are mounted on is the "OUTSIDE".

The chassis has been anodized to enhance its appearance and increase its heat radiating properties. This black finish also happens to be a good insulator. An important design detail of this amplifier is the use of a common-point ground system. This eliminates ground loops which can cause hum or instability.

The common ground-point for your amplifier will be a solder lug in stalled under the mounting foot of TS-1 in the upper left corner. **Ground connections will be distributed from this solder lug to all the circuits.** To make a good electrical connection to the chassis, the anodized surface must be removed.

- ✓ Sandpaper (supplied). On the inside of the chassis, remove the black surface from around the TS-1 mounting hole. The white aluminum should show for at least an eighth of an inch around the hole. Use short circular motions when sanding.

- ✓ TS-1, a 3-terminal standup strip and a solder lug. Mount with a 6-32 x 5/16" screw, lockwasher and nut. Place the solder lug between the mounting foot and the chassis. Place the lockwasher directly under the nut. Position as shown and tighten securely.

- ✓ Remove the black surface from around the pilot light socket hole on the OUTSIDE of the chassis. The socket will be installed later.

- ✓ Large transistor socket for TR-9. Mount on inside of chassis with two FILLISTER-HEAD screws, #6 lockwashers and nuts. Place the lockwasher directly under the nut. **DO NOT USE ANY OTHER KIND OF SCREW TO MOUNT THESE SOCKETS.** Larger heads will short the power transistors, resulting in permanent damage. Notice the "E" and "B" stamped on the sockets. Position the sockets exactly as shown. Figure 16 shows the bottom of the chassis and where each fillister-head screw goes.

- ✓ The five remaining large transistor sockets. Mount in the same manner as above. Be sure you position each socket exactly as shown.

- ✓ TS-2, a 3-terminal standup strip. Mount in the hole closest to the front of the chassis, with a 6-32 x 5/16" screw, lockwasher and nut. Position as shown.

- ✓ TS-3, a 3-terminal standup strip. Mount with a 6-32 x 5/16" screw, lockwasher and nut. Position as shown.

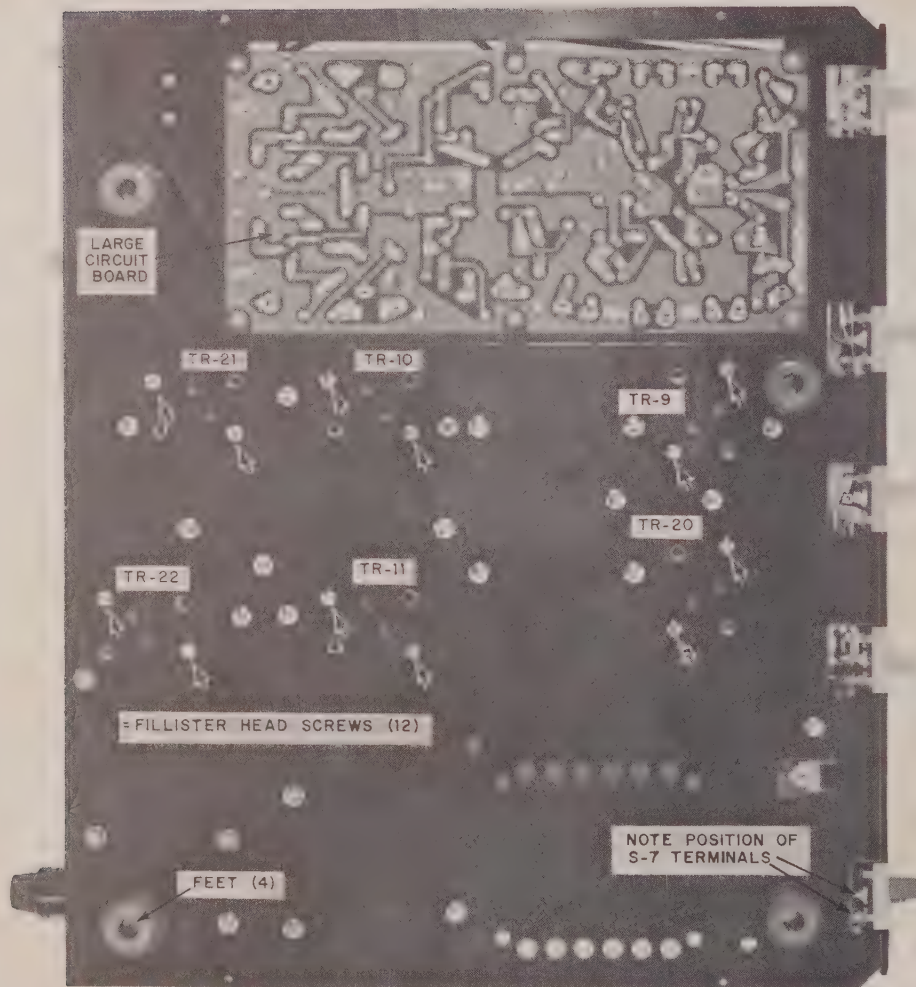


FIGURE 16. BOTTOM VIEW OF CHASSIS

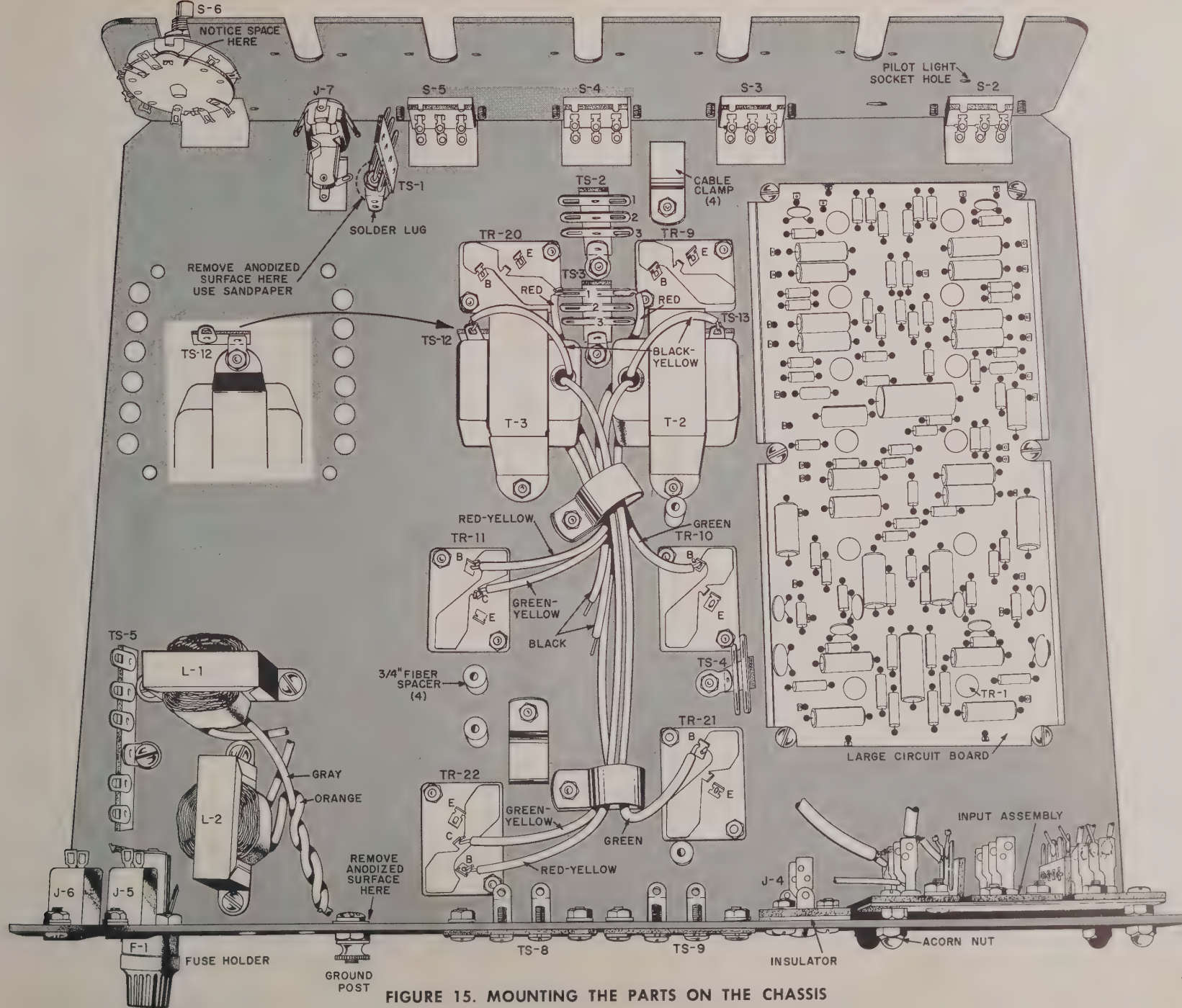


FIGURE 15. MOUNTING THE PARTS ON THE CHASSIS

MOUNTING PARTS ON THE CHASSIS (Continued)

SEE FIGURE 15.

- ✓ TS-4, a 2-terminal standup strip. Mount with a 6-32 x 5/16" screw, lockwasher and nut. Position as shown.
- ✓ 3/4" fiber spacers (4). Mount each with a 4-40 x 5/16" screw and lockwasher. The screw is inserted through the chassis, from the bottom, into the spacer. Lockwashers go directly under the screw heads. Be careful not to over tighten.
- ✓ Cable clamps (4). Mount each where shown with a 6-32 x 5/16" screw, lockwasher and nut. Position each clamp as shown before tightening the nut.

Driver transformers T-2 and T-3 are identical units. Do not insert the transformer leads through the clamps until instructed to do so.

- ✓ Driver transformer T-3 and TS-12, a 1-terminal strip. Position the transformer and terminal strip as shown in the detail on Figure 15. Mount with two 6-32 x 5/16" screws, lockwashers and nuts.
- ✓ Driver transformer T-2 and TS-13, a 1-terminal strip. Mount in a similar manner with the terminal of TS-13 positioned as shown. Fasten with two 6-32 x 5/16" screws, lockwashers and nuts.
- ✓ Chokes L-1 and L-2. Position as shown and mount each with two 6-32 x 5/16" screws, lockwasher and nuts.
- ✓ Fuse holder for F-1 (panel type). Install as in Figure 17, so the rear terminal is positioned as shown.
- ✓ J-5 and J-6, AC receptacles. Install each from **inside** the chassis. Fasten with two 6-32 x 5/16" screws, lockwashers and nuts.
- ✓ TS-5, a 5-terminal strip. Mount with a 6-32 x 5/16" screw, lockwasher and nut.
- ✓ TS-8 and TS-9,, 2-screw strips. Mount each from **OUTSIDE** of chassis, with two 6-32 x 5/16" screws, lockwashers and nuts. Unless otherwise specified, the lockwashers always go directly under the nuts.
- ✓ **On the inside of the chassis**, use sandpaper to remove the black surface from around the ground post hole. Place a #8 lockwasher on the 8-32 x 1/2" screw and insert into this hole. Secure with a #8 hex nut. Now put the #8 knurled nut on the screw.
- ✓ J-4, the 2-jack strip and its insulator. Place the insulator between the jack strip and the chassis. Mount with four 6-32 x 5/16" screws, lockwashers and nuts.
- ✓ Prewired input assembly. Install with the three short red leads toward the outside edge of the chassis. Secure with four acorn nuts.
- ✓ J-7, the stereo headphone jack. Place the small 3/8" internal tooth lockwasher over the bushing; then install in the chassis and secure with a 3/8" nut. Position the jack terminals as shown.
- ✓ S-5, 6-terminal slide switch. Mount from outside the chassis with two 4-40 x 5/16" screws. The chassis holes are threaded.

- ✓ S-2, S-3, and S-4, 6-terminal slide switches. Mount in the same manner as S-5 with 4-40 x 5/16" screws.
- ✓ S-6, single wafer switch. Mount so the terminals are positioned as shown. Fasten with a 3/8" lockwasher and nut. Be sure the locating tabs engage the holes in the chassis before tightening.

NOTE: Do not use lockwashers when mounting the large circuit board.

- ✓ Prewired large printed circuit board. Install from the outside of chassis with six 4-40 x 5/16" screws, and nuts. Notice that the TR-1, TR-12 end of the board is closer to the input assembly.

Connect the leads from the driver transformers as follows:

- ✓ Green/yellow lead from T-3. Feed through the two clamps and connect to terminal C of TR-22.
- ✓ Red/yellow lead from T-3. Feed through the two clamps and connect to terminal B of TR-22.
- ✓ Green lead from T-3. Feed through the two clamps and connect to terminal B of TR-21.
- ✓ Green/yellow lead from T-2; shorten to 4". Feed through the clamp and connect to terminal C of TR-11.
- ✓ Red/yellow lead from T-2; shorten to 4". Feed through the clamp and connect to terminal B of TR-11.
- ✓ Green lead from T-2; shorten to 3". Connect to terminal B of TR-10.
- ✓ Black leads from T-2 and T-3. They will be routed and connected later.
- ✓ Red lead from T-2. Solder to terminal 1 of TS-3 (right side of terminal only).
- ✓ Black/yellow lead from T-3. Shorten to 3" and connect to the terminal of TS-12.
- ✓ Red lead from T-3. Connect to the left side of terminal 1 of TS-3.
- ✓ Black/yellow lead from T-2. Shorten to 3" and connect to the terminal of TS-13.

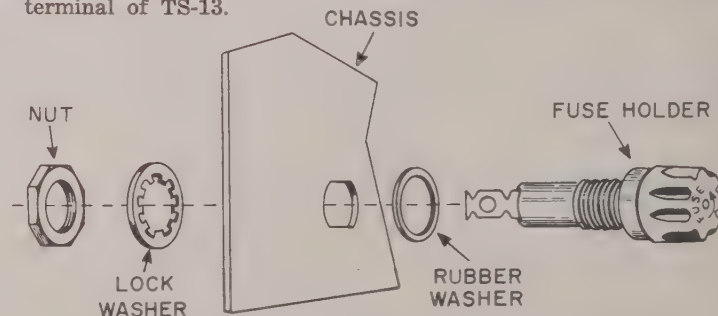


FIGURE 17. FUSEHOLDER MOUNTING

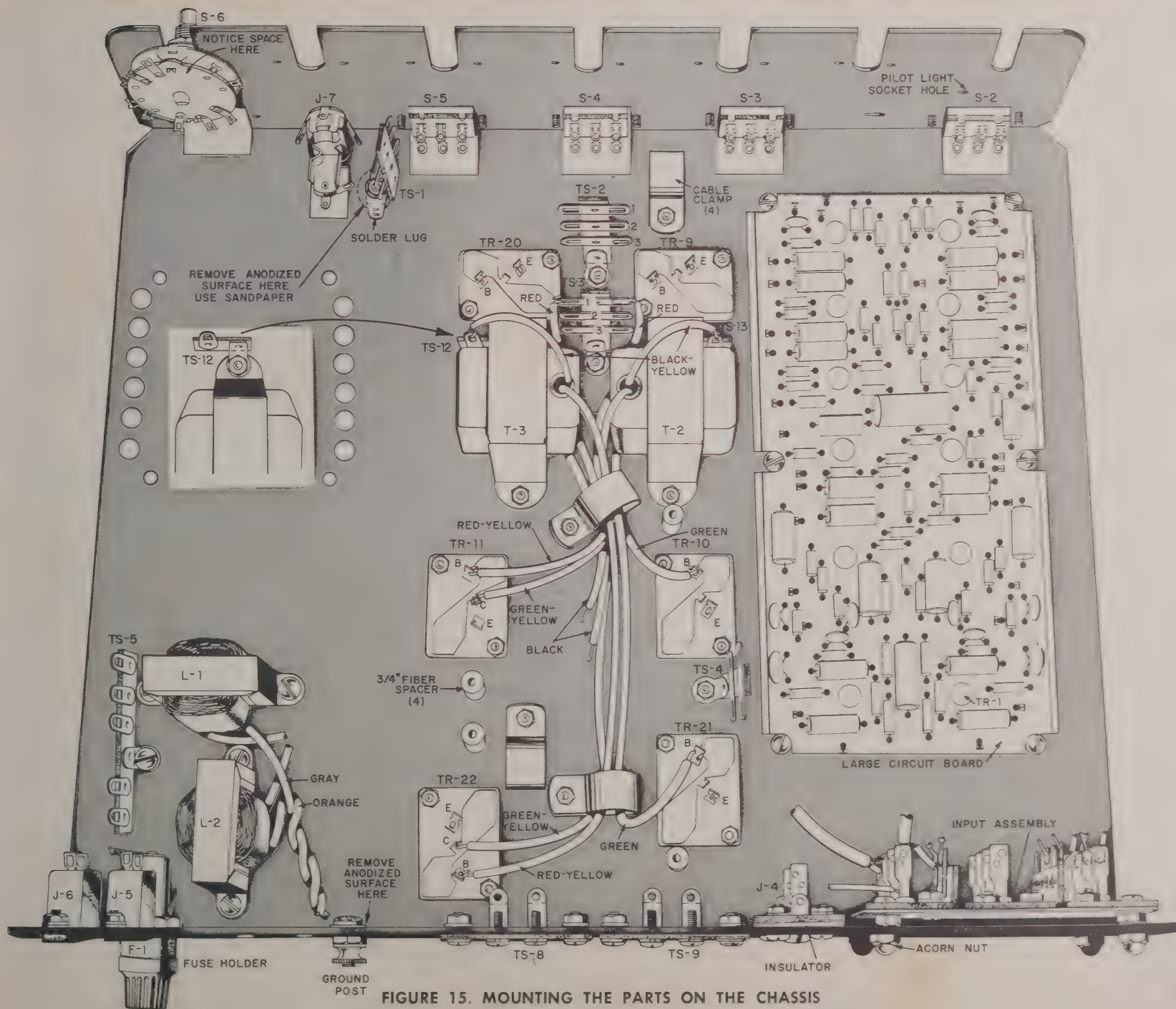


FIGURE 15. MOUNTING THE PARTS ON THE CHASSIS

FIRST WIRING OF THE CHASSIS

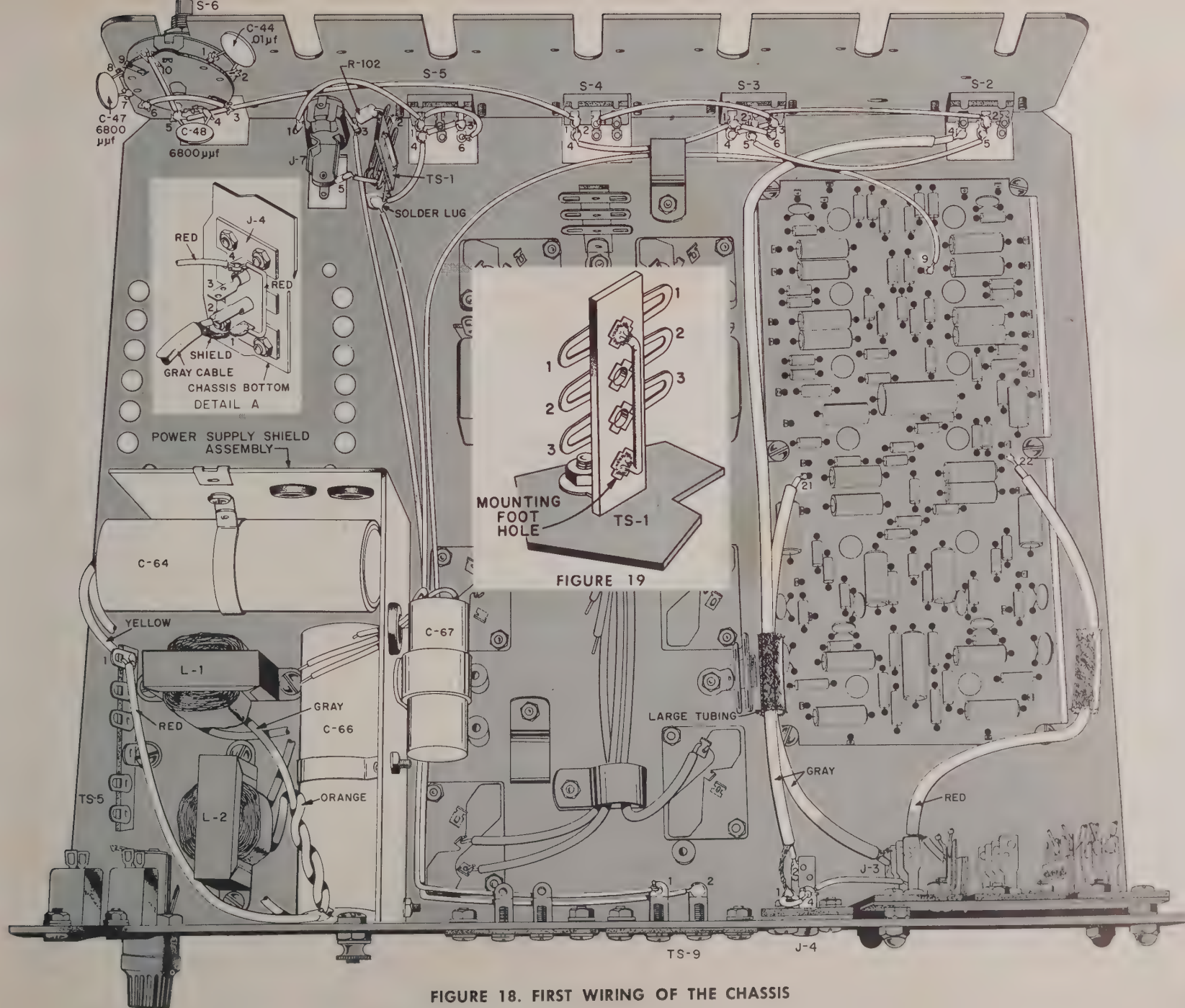
SEE FIGURE 18 ON PAGE 23

- ☒ 1" length of large, black tubing. Cut off all the shield strands from the free end of the gray shielded cable coming from the input assembly. Slip the tubing over the cable; then solder the inner conductor to terminal 21 on the circuit board.
- ☒ 1" large black tubing. Cut off all the shield wires from the free end of the red shielded cable coming from the input assembly. Slip the tubing over the cable and solder the inner conductor to terminal 22 on the circuit board.

NOTE: SEE DETAIL A ON FIGURE 18.

- ☒ 13" gray shielded cable. At one end of the cable, twist the shield strands together and connect to terminal 1 of J-4. Solder the inner conductor from this end to terminal 2 of J-4. Cut off all of the shield strands from the other end of the cable. Push this end through the tubing shown and solder the inner conductor to terminal 4 of S-2.
- ☒ Free end of red wire from J-3. Connect to terminal 4 of J-4.
- ☒ 2" red wire. Solder one end to terminal 1 of J-4 (2 wires). Connect the other end to terminal 4 of J-4.
- ☒ 1" bare wire. Solder one end to terminal 6 of S-3. Slip $\frac{1}{2}$ " small tubing over the other end and connect it to terminal 1 of S-3.
- ☒ 1" bare wire. Solder one end to terminal 4 of S-3. Slip $\frac{1}{2}$ " small tubing over the other end and connect it to terminal 3 of S-3.
- ☒ White/black wire. Solder one end to terminal 5 of S-3. Solder the other end to terminal 5 of S-2.
- ☒ White/black wire. Solder one end to terminal 2 of S-3. Solder the other end to terminal 2 of S-2.
- ☒ 3" orange wire. Solder one end to terminal 3 of S-3 (2 wires). Connect the other end to terminal 2 of S-4.
- ☒ 3" orange wire. Solder one end to terminal 1 of S-3 (2 wires). Remove an additional $\frac{1}{2}$ " of insulation from the other end. Route the wire through the clamp and push this end through terminal 4 of S-4 and connect it to terminal 1 of S-4.
- ☒ Blue wire. Connect one end to terminal 5 of S-6. Solder the other end to terminal 1 of S-4 (2 wires). Also solder terminal 4 of S-4.
- ☒ 1" bare wire. Connect one end to terminal 4 of S-5. Slip a $\frac{1}{2}$ " small tubing over the other end and solder it to terminal 3 of S-5.
- ☒ 2" red wire. Solder one end to terminal 4 of S-5 (2 wires). Connect the other end to the solder lug.
- ☒ 2" red wire. Connect one end to terminal 1 of S-5. Connect the other end to terminal 6 of S-5.

- ☒ $2\frac{1}{2}$ " white/green wire. Solder one end to terminal 1 of S-5 (2 wires). Solder the other end to terminal 1 of J-7.
- ☒ R-102, 220 Ω resistor (red, red, brown). Connect one lead to terminal 3 of J-7. Solder the other lead to terminal 2 of TS-1.
- ☒ Power supply shield-assembly. Install where shown. Fasten the spade-bolts with two #6 lockwashers and nuts.
- ☒ 16" white/blue wire. Solder one end to terminal 3 of J-7 (2 wires). Route the other end of this wire through the clamp as shown; then solder to terminal 2 of TS-9.
- ☒ $1\frac{1}{4}$ " bare wire. Solder one end to terminal 5 of J-7. Slip a $\frac{3}{4}$ " length of small tubing over the other end and connect it to terminal 3 of TS-1.
- ☒ $1\frac{3}{4}$ " bare wire. See Figure 19. Insert the tip of one end into the center hole in the mounting foot of TS-1 and solder. Slip a 1" length of small tubing over the other end of the wire. Push this end of the wire into the center hole in terminal 1 (the top hole) of TS-1 and solder.
- ☒ 15" white/green wire. Solder one end to the solder lug (2 wires). This is an important connection; be sure it is properly soldered. Route the other end of this wire through the clamp, as shown; then connect it to terminal 1 of TS-9.
- ☒ C-44, .01 μf disc capacitor. Connect one lead to terminal 1 of S-6. Connect the other lead to terminal 2 of S-6.
- ☒ 2" red wire. Connect one end to terminal 5 of S-6. Connect the other end to terminal 10 of S-6.
- ☒ C-48, 6800 μf disc capacitor. Solder one lead to terminal 5 of S-6 (3 wires). Solder the other end to terminal 4 of S-6.
- ☒ 2" red wire. Connect one end to terminal 3 of S-6. Solder the other end to terminal 6 of S-6.
- ☒ C-47, 6800 μf disc capacitor. Solder one lead to terminal 7 of S-6. Connect the other lead to terminal 8 of S-6.
- ☒ Loosely twist together the gray lead from L-1 and the orange lead from L-2. Route these leads along with the yellow lead from C-66 toward the ground post.
- ☒ Connect the red lead from C-66 to terminal 1 of TS-5.
- ☒ Cut the yellow lead from C-64 to $1\frac{3}{4}$ ". Remove $\frac{1}{8}$ " of insulation from this end. Insert the wire end into the hole in the bottom of terminal 1 of TS-5. Solder only this hole. Do not allow solder to flow down onto the chassis.
- ☒ White/gray wire. Solder one end to terminal 9 on the circuit board. Route the other end through the clamp and into the grommet in the power supply shield.



SECOND WIRING OF THE CHASSIS

SEE FIGURE 20 ON PAGE 25

- ☒ Gray wire. Solder one end to terminal 8 of S-6 (2 wires). Remove an additional $\frac{1}{4}$ " of insulation from the other end. Push this end down through terminal 3 of S-4 and solder it to terminal 6 of S-4. Solder terminal 3 of S-4.
- ☒ Blue wire. Solder one end to terminal 2 of S-6 (2 wires). Solder the other end to terminal 2 of S-4 (2 wires).
- ☒ R-103, 220 Ω resistor (red, red, brown). Solder one lead to terminal 3 of TS-1. Slip a $\frac{3}{4}$ " length of small tubing over the other lead and solder it to terminal 6 of S-5 (2 wires).
- ☒ 14" white/yellow wire. Solder one end to terminal 5 of S-5. Route the other end through the clamp and solder it to terminal 2 of TS-8.
- ☒ White/orange wire. Solder one end to terminal 2 of S-5. Route the other end through the clamp as shown and solder it to terminal 1 of TS-8.
- ☒ 10" brown wire. Solder one end to terminal 3 of TS-1 (2 wires). Route the other end through the clamp and connect it to terminal C of TR-22.
- ☒ Violet wire. Connect one end to terminal 2 of TS-1. Connect the other end to terminal C of TR-11.
- ☒ 2" red wire. Solder one end to terminal 4 of J-7. Solder the other end to terminal 2 of TS-1 (2 wires).
- ☒ 2" red wire. Solder one end to terminal 2 of J-7. Connect the other end to terminal 1 of TS-1.
- ☒ Gray wire and 1" large tubing. Solder one end to terminal 6 of S-2. Route the other end through the tubing and solder it to terminal 19 on the circuit board.
- ☒ Green wire. Solder one end to terminal 3 of S-2. Solder the other end to terminal 20 on the circuit board.
- ☒ 2" red wire. Solder one end to terminal 3 of S-6 (2 wires). The other end will be connected later.
- ☒ 14 $\frac{1}{2}$ " red shielded cable. Solder the inner conductor on one end to terminal 3 of J-4. Solder the shield wire from this end to terminal 4 of J-4 (3 wires). Cut off the shield strands from the other end. Push this end through the tubing, as shown; then solder the inner conductor to terminal 1 of S-2.
- ☒ Pilot light socket and I-3, a #1819 pilot lamp. Install the lamp into the socket. Place a clip nut over the socket bracket, so the smooth side of the nut faces away from the socket. Mount this assembly on the chassis, with a 6-32 x 5/16" screw.
- ☒ Violet wire. Solder one end to the lamp socket terminal. Slip through the tubing and clamp; Solder to terminal 1 of TS-2.

- ☒ R-94, 65 Ω 7-watt resistor. Connect one lead to terminal 3 of TS-3. Push the other lead through terminal 3 of TS-2. Slip $\frac{1}{2}$ " small tubing over the end and connect it to terminal E of TR-20. Solder terminal 3 of TS-2.
- ☒ C-70, 5 μ f, 15V electrolytic capacitor. Connect the + lead to terminal E of TR-20. Connect the other lead to the terminal of TS-12.
- ☒ R-111, 20 Ω 5% resistor (red, black, black). Solder one lead to the terminal of TS-12 (3 wires). Solder the other lead to terminal E of TR-20 (3 wires).
- ☒ 2" red wire. Solder one end to terminal 3 of TS-3 (2 wires). Connect the other end to terminal 1 of TS-3.
- ☒ 2" red wire. Solder one end to terminal C of TR-20. Solder the other end to terminal 2 of TS-2.
- ☒ Violet wire. Solder one end to terminal 3 of TS-3. Route the other end through the clamp and solder it to terminal 1 of TS-4.
- ☒ R-95, 65 Ω 7-watt resistor. Connect one lead to terminal 2 of TS-2. Connect the other lead to terminal 2 of TS-3.
- ☒ Gray wire. Solder one end to terminal C of TR-9. Route the other end through the clamp, as shown; then connect it to terminal 2 of TS-4.
- ☒ 2" red wire. Solder one end to terminal C of TR-10. Connect the other end to terminal 2 of TS-4.
- ☒ 2" red wire. Solder one end to terminal C of TR-21. Connect the other end to terminal 2 of TS-4.
- ☒ White/blue wire. Solder one end to terminal 1 of S-6 (2 wires). Route the other end through the clamp and tubing, as shown. Solder this end to terminal 16 on the circuit board.
- ☒ White/orange wire. Connect one end to terminal 9 of S-6. Route the other end through the clamp; then solder it to terminal 15 on the circuit board.
- ☒ C-43, .01 μ f disc capacitor. Solder one lead to terminal 9 of S-6 (2 wires). Solder the other lead to terminal 10 of S-6 (2 wires).
- ☒ STOP! Carefully check your work at the end of each page. This is a good time to relax. Don't try to do too much at any one time.



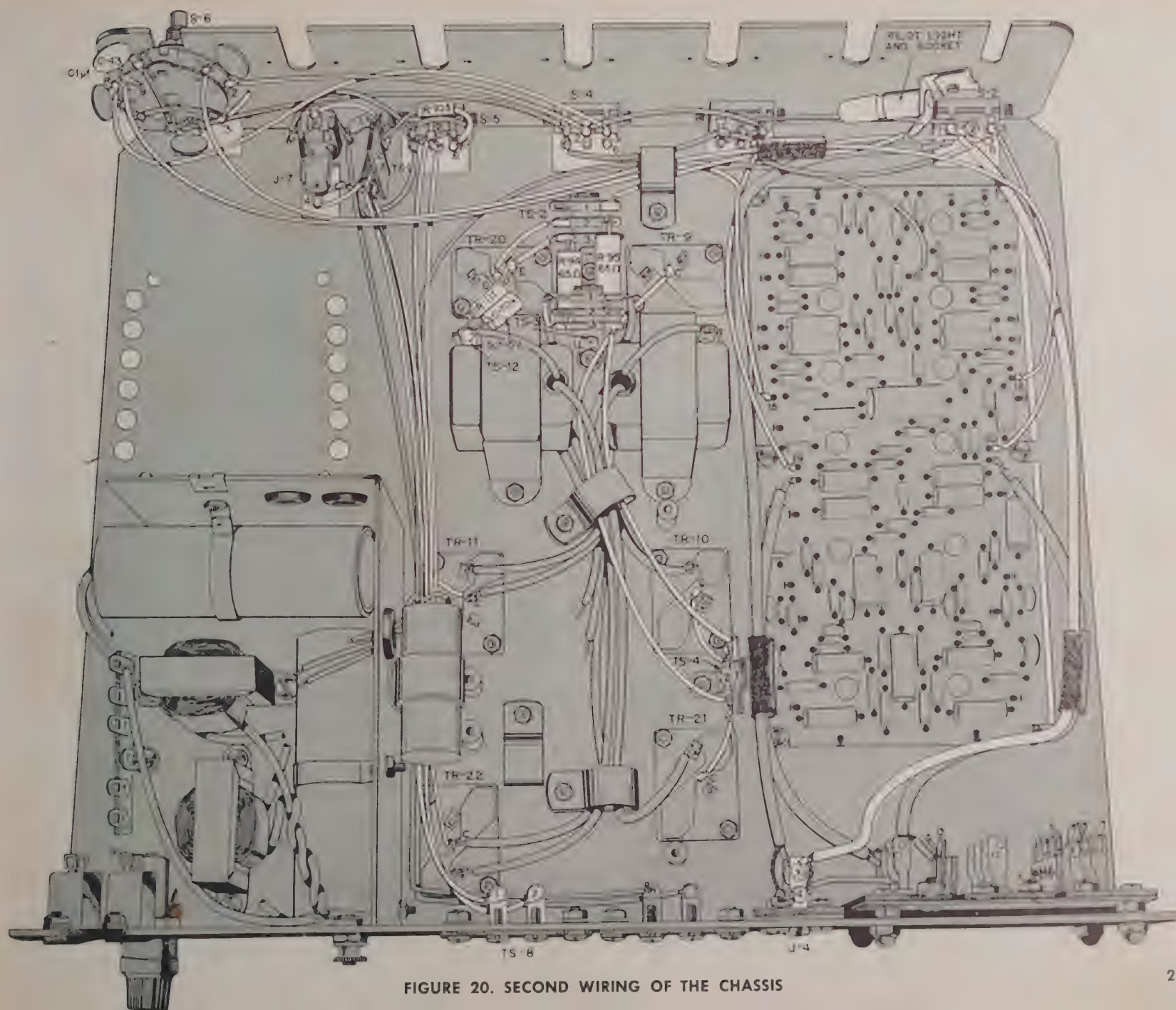


FIGURE 20. SECOND WIRING OF THE CHASSIS

THIRD WIRING OF THE CHASSIS

SEE FIGURE 24 ON PAGE 27

- ☒ S-7, 4-terminal slide switch and two white/brown wires. Remove an extra $\frac{1}{4}$ " of insulation from one end and twist the wires together for their entire length. See Figure 23. Push the end of one wire down through terminal 1 into terminal 3. Solder both terminals. Push the other wire end on the same end of the wired pair, down through terminal 2 into terminal 4. Solder both terminals.
- ☒ Mount this assembly to the chassis with two 4-40 x $\frac{5}{16}$ " screws. Note the terminals must face toward the edge of the chassis, as shown in Figure 16, on Page 18.

SEE FIGURE 21.

- ☒ Transformer shield. Install the $\frac{5}{16}$ " rubber grommet.
- ☒ 2 spade bolts. Attach to the shield with a 6-32 x $\frac{5}{16}$ " screw, lockwasher and nut. Notice that the shoulder is away from the shield.
- ☒ C-72, 68, 71. 1000 μ f electrolytic capacitors. Mount as shown in Figure 22 with 2 felt pads, jack support strip and two 6-32x1- $\frac{1}{4}$ " screws, lockwashers and nuts. Push all six wires through the grommet on the power supply shield.

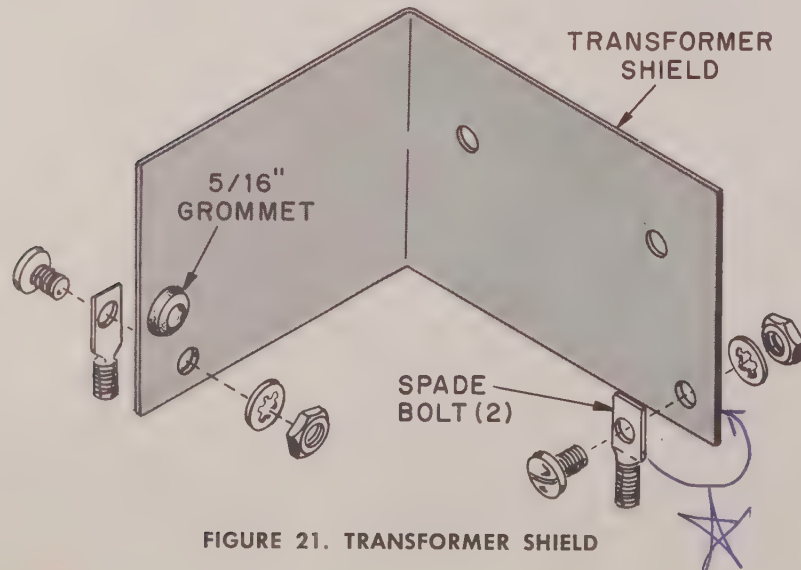


FIGURE 21. TRANSFORMER SHIELD

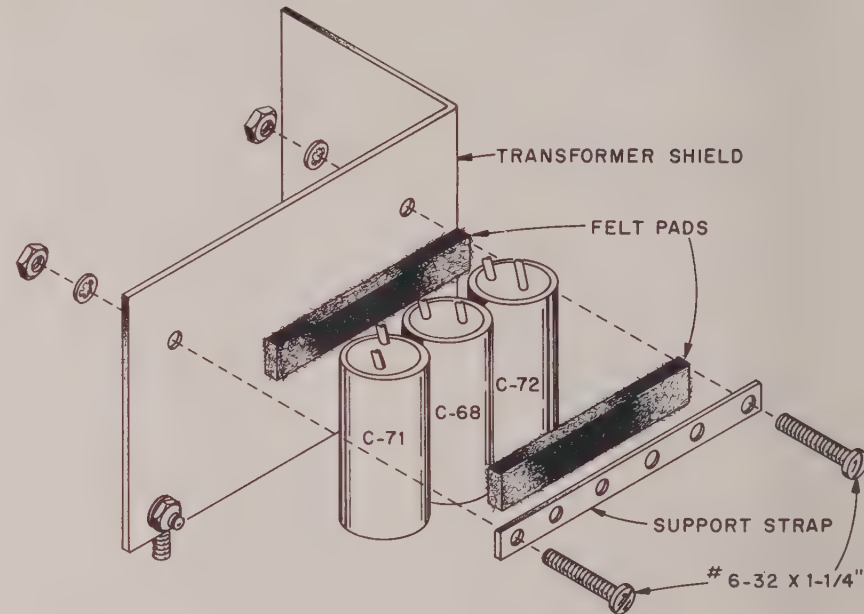


FIGURE 22. MOUNTING C-68, C-71 AND C-72

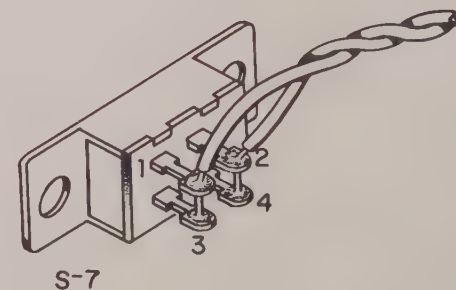


FIGURE 23. WIRING S-7

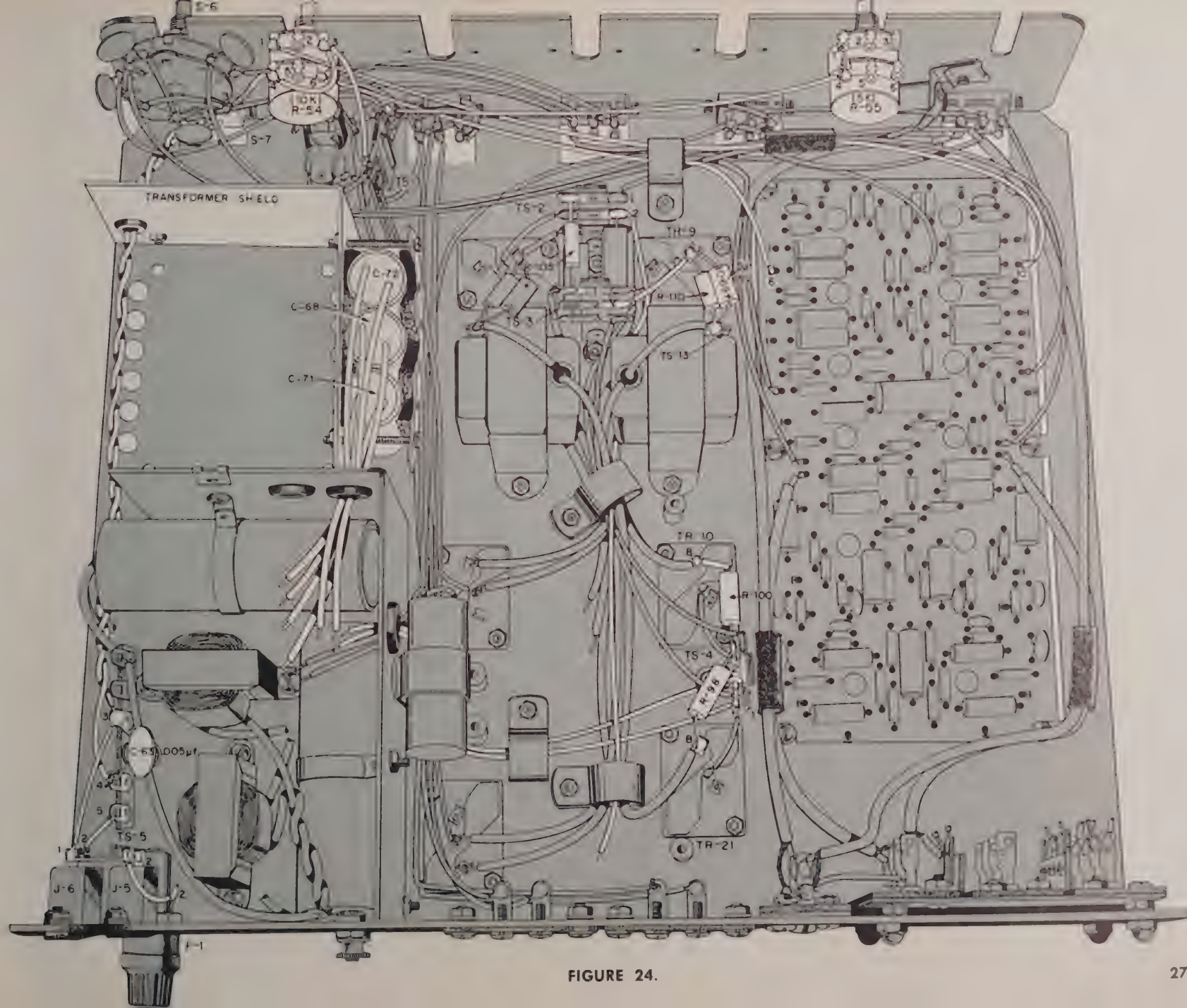


FIGURE 24.

THIRD WIRING OF THE CHASSIS—Continued

SEE FIGURE 24.

- ☒ Transformer shield. Insert the white/brown twisted wires from S-7 through the hole in the grommet on the shield. Insert the spade bolt ends through the holes in the chassis. Fasten with two #6 lockwashers and nuts.
- ☒ Connect the free end of either of the white/brown wires from S-7 to terminal 3 of TS-5. Connect the other white/brown wire to terminal 4 of TS-5.
- ☒ C-63, .005 μ f disc capacitor. Connect one lead to terminal 3 of TS-5. Connect the other lead to terminal 4 of TS-5.
- ☒ 1" bare wire. Connect one end to terminal 2 of J-6. Solder the other end to terminal 2 of J-5.
- ☒ 1" bare wire. Connect one end to terminal 1 of J-6. Connect the other end to terminal 1 of J-5.
- ☒ 4" yellow wire. Solder one end to terminal 1 of J-6 (2 wires). Solder the other end to terminal 3 of TS-5 (3 wires).
- ☒ 2" red wire. Connect one end to terminal 2 of J-6. Connect the other end to terminal 5 of TS-5.
- ☒ 2" red wire. Solder one end to terminal 2 of F-1. Solder the other end to terminal 1 of J-5 (2 wires).
- ☒ R-54, 10K dual control (Part no. 420-159). Mount on the chassis with a $\frac{3}{8}$ " lockwasher and nut. Be sure the locating tabs engage the holes in the chassis.
- ☒ R-55, 5K dual control (Part no. 420-162). Mount in same manner as R-54.
- ☒ Free end of red wire from S-6. Connect to terminal 4 of R-54.

Look ahead to Figure 37 on page 43 to see how the printed circuit wiring must be positioned to accept the shield. Keep this layout in mind as you wire to the large printed circuit board.

- ☒ Gray wire. Solder one end to terminal 6 of R-54. Route the other end through the clamp and solder it to terminal 8 on the printed circuit board.

- ☒ 12" white/red wire. Solder one end to terminal 1 of R-54. Route the other end through the clamp and tubing. Solder this end to terminal 10 of the circuit board.
- ☒ 2" red wire. Solder one end to terminal 4 of R-54 (2 wires). Connect the other end to terminal 3 of R-54.
- ☒ 2" red wire. Solder one end to terminal 3 of R-54 (2 wires). Connect the other end to terminal 1 of TS-1.
- ☒ 7" yellow wire. Solder one end to terminal 1 of TS-1 (2 wires on this side of the terminal). Connect the other end to terminal 4 of R-55.
- ☒ $\frac{3}{4}$ " bare wire. Solder one end to terminal 4 of R-55 (2 wires). Connect the other end to terminal 1 of R-55.
- ☒ R-105, 560 Ω resistor (green, blue, brown). Solder one lead to terminal 1 of TS-2. Solder the other lead to terminal 1 of TS-3 (3 wires).
- ☒ 10 $\frac{1}{2}$ " yellow wire. Solder one end to terminal 2 of TS-2 (2 wires). Route the other end through the clamps; it will be connected later.
- ☒ R-100, 1.2K, 5% 1 watt resistor (brown, red, red). Slip $\frac{1}{2}$ " small tubing over one lead and solder to terminal B of TR-10 (2 wires). Connect the other lead to terminal 2 of TS-4.
- ☒ 2" red wire. Connect one end to terminal E of TR-9. Solder the other end to terminal 2 of TS-3 (2 wires).
- ☒ C-69, 5 μ f 15V electrolytic capacitor. Connect the + lead to the terminal of TS-13. Connect the other lead to terminal E of TR-9.
- ☒ R-110, 20 Ω 5% resistor (red, black, black). Solder one lead to the terminal of TS-13 (3 wires). Solder the other lead to terminal E of TR-9 (3 wires).
- ☒ 7 $\frac{1}{2}$ " brown wire. Solder one end to terminal 2, the bottom terminal, of TS-4 (3 wires). Push the other end through the clamps and grommet shown. This end will be connected later.
- ☒ Gray wire. Connect one end to terminal 1, the top terminal, of TS-4. Push the other end through the clamps and grommet shown. This end will be connected later.
- ☒ R-98, 1.2K, 5% 1-watt resistor (brown, red, red). Solder one lead to terminal 2 of TS-4 (3 wires). Solder the other lead to terminal B of TR-21 (2 wires).
- ☐ Carefully inspect your wiring. Go back over each step on pages 26 and 28.





FIGURE 24.

FOURTH WIRING OF THE CHASSIS

SEE FIGURE 25 ON PAGE 31

- ☒ R-52, 50K dual control (Part no. 420-160). Mount on the chassis with a $\frac{3}{8}$ " lockwasher and nut. Be sure the locating tabs engage the holes in the chassis.
- ☒ R-53, 10K dual control, (part no. 420-161). Mount in the same manner as R-52.
- ☒ R-56, 100K dual control (Part no. 420-163). Mount in the same manner as R-52.
- ☒ Gray wire. Solder one end to terminal 2 of R-54. Solder the other end to terminal 3 of R-55.
- ☒ Gray wire. Connect one end to terminal 2 of R-56. Push the other end through the tubing and solder it to terminal 7 on the circuit board.

CAUTION :When you solder to the terminals on the circuit board, avoid burning the adjacent wires and components on the board. Temporarily push wires to one side to protect them when necessary.

- ☒ Blue wire. Solder one end to terminal 1 of R-56. Push the other end through the tubing and solder it to terminal 5 of the circuit board.
- ☒ C-45, 820 $\mu\mu\text{f}$ disc capacitor. Solder one lead to terminal 2 of R-56 (2 wires). Connect the other lead to terminal 3 of R-56.
- ☒ 2" red wire. Solder one end to terminal 3 of R-56 (2 wires). Solder the other end to terminal 2 of R-55.
- ☒ 3" orange wire. Solder one end to terminal 1 of R-55 (2 wires). Solder the other end to terminal 1 on the circuit board.
- ☒ White/brown wire. Connect one end to terminal 2 of R-52. Push the other end through the clamp and tubing; then solder it to terminal 14 on the circuit board.
- ☒ 8 $\frac{1}{2}$ " white/yellow wire. Connect one end to terminal 5 of R-52. Push the other end through the clamp; then solder it to terminal 13 on the circuit board.
- ☒ 10" black wire. Connect one end to terminal 3 of R-53. Push the other end through the clamp and tubing. Solder this end to terminal 12 on the circuit board.

- ☒ Blue wire. Connect one end to terminal 6 of R-53. Push the other end through the clamp and solder it to terminal 11 on the circuit board.
- ☒ Power supply sub-assembly. Fasten to the rear of the chassis, with two 6-32 x 5/16" screws. Be sure to bring the twisted gray and orange leads, and the yellow lead from the capacitor out at the corner of the bracket.

Connect these leads as follows:

- ☒ Yellow lead. Connect to terminal 2 of F-3.
- ☒ Orange lead. Solder to terminal 2 of F-3 (2 wires).
- ☒ Gray lead. Connect to terminal 2 of F-2.
- ☒ 2 $\frac{1}{2}$ " white/yellow wire. Connect one end to terminal 1 of TS-5. Connect the other end to terminal 1 of TS-6.
- ☒ Solder the orange wire from L-1 to terminal 4 of TS-6 (2 wires).
- ☒ Solder the gray wire from L-2 to terminal 5 of TS-6 (3 wires).
- ☒ Solder the red lead from C-64 to terminal 3 of TS-6 (3 wires).

Connect the leads from C-67, 68, 71 and 72 as follows:

- ☒ Red lead from C-67. Solder to Terminal 2 of F-2 (2 wires).
- ☒ Yellow lead from C-67. Connect to Terminal 1 of TS-7.
- ☒ Red lead from C-72. Connect to Terminal 1 of TS-7.
- ☒ Yellow lead from C-72. Connect to Terminal 7 of TS-7.
- ☒ Red lead from C-68. Connect to Terminal 1 of TS-7.
- ☒ Yellow lead from C-68. Connect to Terminal 6 of TS-7.
- ☒ Red lead from C-71. Connect to Terminal 8 of TS-7.
- ☒ Yellow lead from C-71. Connect to Terminal 1 of TS-7.

Connect the free ends of the wires from grommet A as follows:

- ☒ Gray. Solder to terminal 1 of F-2 (2 wires).
- ☒ Brown. Solder to terminal 1 of F-3 (2 wires).
- ☒ White/gray. Solder to terminal 6 of TS-7 (3 wires). Do not burn adjacent wires.
- ☒ You have just finished the Fourth Wiring. (only two more to go!) Just to be safe, won't you go back and check each step in the Fourth Wiring.

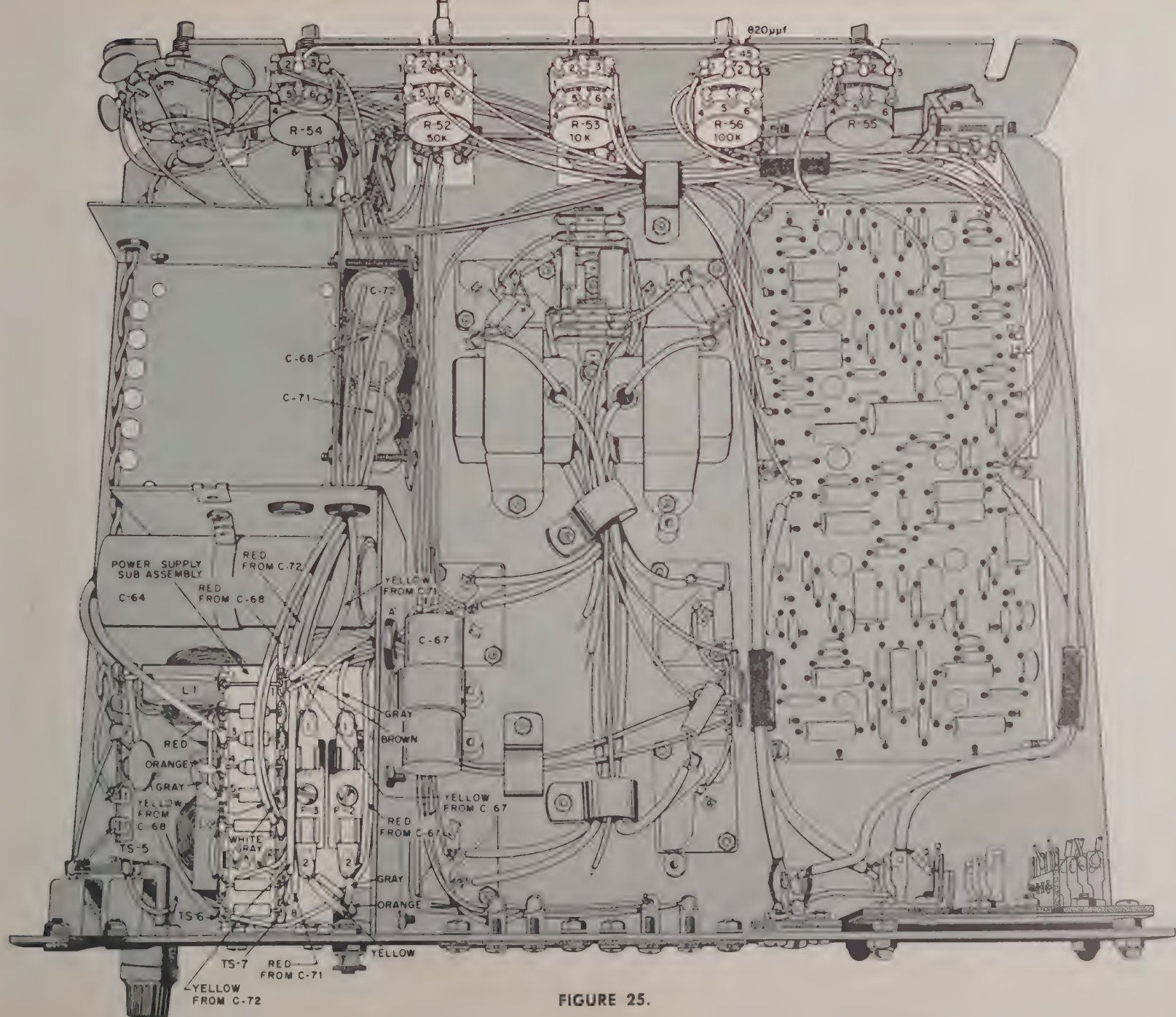


FIGURE 25.

FIFTH WIRING OF THE CHASSIS

SEE FIGURES 26 AND 27

- ☒ Two clip nuts. Push on switch bracket, as shown.
- ☒ Pre-wired switch S-1 and switch bracket. Mount switch to bracket with a $\frac{3}{8}$ " nut; do not use a lockwasher. Be sure the switch locating tab engages in the hole in the bracket.
- ☒ Place this switch assembly on the chassis where shown. Let the switch shaft rest in the remaining slot in the chassis front.
- ☒ When connecting switch wires route exactly as shown. Notice that the green wire from wafer B goes around the front of the switch bracket, not behind it.
- ☒ Switch bushing. Slip the bushing over the S-1 shaft. Lift the shaft out of the slot enough to slide the bushing down beyond the chassis front; then push the bushing forward into the hole. Fasten the bushing loosely with a $\frac{3}{8}$ " lockwasher and nut.
- ☒ Secure the switch bracket from the bottom of the chassis with two 6-32 x 5/16" screws. The screws go through the chassis into the clip nuts on the bracket.
- ☒ Solder the free end of the bare wire from terminal 2 of J-1 to terminal 6 of wafer B (2 wires). Make sure both of the lugs that make up terminal 6 are soldered.
- ☒ Solder the free end of the red wire from terminal 1 of J-1 to terminal 5 of wafer A.
- ☒ Bare wire from terminal 3 of J-1. Slip $\frac{5}{8}$ " tubing over this wire and solder to terminal 5 of wafer B.
- ☒ Solder the free end of the red wire from terminal 6 of J-1 to terminal 4 of wafer B.
- ☒ Solder the free end of the red wire from terminal 4 of J-1 to terminal 4 of wafer A.

Connect the wires from S-1 as follows:

- ☒ Violet wire from wafer A. Push through the tubing on the right side of the chassis, and solder to terminal 18 on the circuit board.
- ☒ Blue wire from wafer A. Push through the tubing on the right side of the chassis, and solder to terminal 24 on the circuit board.
- ☒ Green wire from wafer A. Push through the tubing and solder to terminal 26 on the circuit board.

- ☒ Red wire from wafer A. Solder to terminal 30 on the circuit board.
- ☒ Orange wire from wafer A. Solder to terminal 32 on the circuit board.
- ☒ Yellow wire from wafer A. Solder to terminal 28 on the circuit board.

NOTE: Route the green wire around the front of the switch bracket.

- ☒ 1" red tubing. Route the green wire from wafer B through the red tubing and solder it to terminal 29 on the circuit board.
- ☒ Gray wire from wafer B. Push through both pieces of tubing and solder to terminal 17 on the circuit board.
- ☒ Yellow wire from wafer B. Push through both pieces of tubing and solder to terminal 23 on the circuit board.
- ☒ Violet wire from wafer B. Push through the tubing and solder to terminal 25 on the circuit board.
- ☒ Blue wire from wafer B. Push through the tubing and solder to terminal 27 on the circuit board.

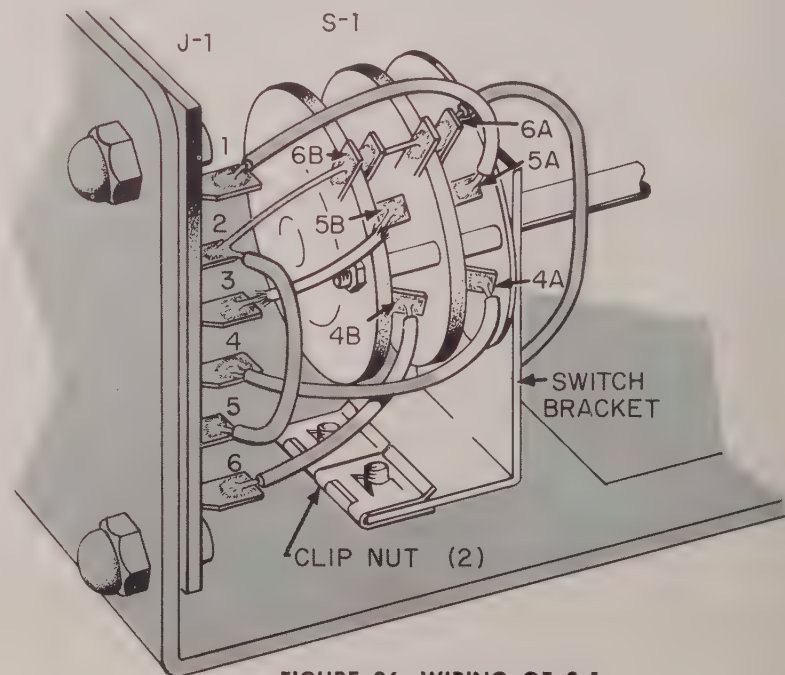


FIGURE 26. WIRING OF S-1

FIFTH WIRING OF THE CHASSIS—Continued

SEE FIGURE 27.

- ☒ Free end of red wire from terminal 1 of TS-10 (the top terminal). Solder to terminal 10 of S-1A. Be sure both lugs are soldered.
- ☒ Free end of orange wire from terminal 2 of TS-10 (the center terminal). Solder to terminal 31 on the circuit board.
- ☒ Free end of red wire from terminal 3 of TS-10 (the bottom terminal). Solder to terminal 10 of wafer B (both lugs).
- ☒ Bare wire from terminal 3 of TS-11. Slip $\frac{3}{4}$ " tubing over the end and solder it to terminal 9 of wafer B (both lugs).
- ☒ Bare wire from terminal 1 of TS-11. Slip 1" tubing over the end and solder it to terminal 9 of wafer A (both lugs).
- ☒ PC-1 and PC-2, packaged circuits. Prepare as shown in Figure 28. Figure 28 is shown actual size. Use it as a template for cutting leads and tubing.
- ☒ Position PC-1 as shown. Connect the no. 1 lead to terminal 1 of TS-1. NOTE: the numbers stenciled on PC-1 will not be visible when the part is correctly mounted.
- ☒ Solder the no. 2 lead to terminal 1 of R-52.
- ☒ Solder the no. 4 lead to terminal 2 of R-52 (2 wires).
- ☒ Solder the no. 5 lead to terminal 3 of R-52.
- ☒ Solder the no. 3 lead to terminal 1 of R-53.
- ☒ Solder the no. 6 lead to terminal 2 of R-53.
- ☒ Solder the no. 7 lead to terminal 3 of R-53 (2 wires).
- ☒ 9" white wire. Solder one end to terminal 5 of R-54. Solder the other end to terminal 6 of R-55.
- ☒ $3\frac{1}{2}$ " white/black wire. Solder one end to terminal 4 of R-56. Solder the other end to terminal 2 of the circuit board.
- ☒ 3" orange wire. Connect one end to terminal 5 of R-56. Solder the other end to terminal 6 on the circuit board.
- ☒ C-46, 820 $\mu\mu\text{f}$ disc capacitor. Solder one lead to terminal 5 of R-56 (2 wires). Connect the other lead to terminal 6 of R-56.
- ☒ 2" red wire. Solder one end to terminal 6 of R-56 (2 wires). Solder the other end to terminal 5 of R-55.
- ☐ Power transformer T-1. Attach four clip nuts to the transformer feet as shown in Figure 29.
- ☒ Place the transformer on the chassis so the transformer leads are positioned as shown. Push the two red wires and one red/yellow wire through the grommet. Fasten T-1 with four 6-32 x 5/16" screws and 4 large #6 flatwashers.
- ☒ Twist the black transformer leads together. Solder either of these leads to terminal 5 of TS-5 (2 wires). Solder the remaining black lead to terminal 1 of F-1.

- ☒ Solder the red/yellow lead from T-1 to terminal 1 of TS-6 (3 wires).
- ☒ Solder either of the red leads from T-1 to terminal 2 of TS-7 (3 wires).
- ☒ Solder the remaining red lead from T-1 to terminal 4 of TS-7. (3 wires).
- ☒ 14" white/yellow wire. Solder one end to terminal 7 of TS-7 (3 wires). Route the other end through grommet and clamps; it will be connected later.
- ☒ White/orange wire. Solder one end to terminal 8 of TS-7 (3 wires). Route the other end through the grommet and clamps; it will be connected later.
- ☒ Violet wire. Solder one end to terminal 1 of TS-7 (6 wires). Push the other end through the grommet and the clamp; it will be connected later.
- ☒ Go back and check each step of this "Fifth Wiring". Make sure the terminals of TS-6 and TS-7 are correctly wired and soldered.

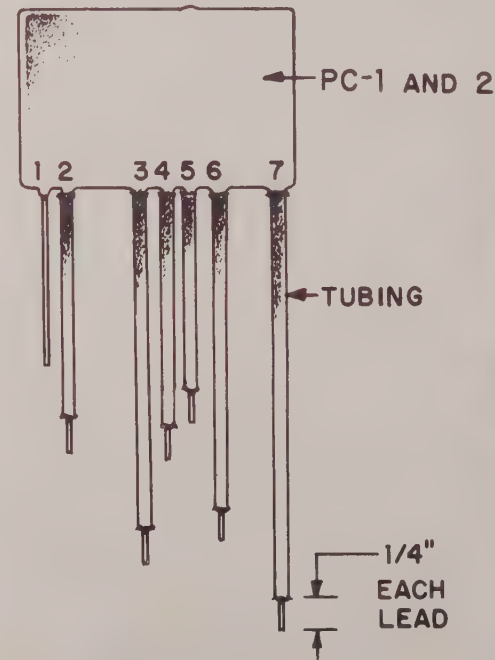


FIGURE 28. TEMPLATE FOR PC-1 AND PC-2

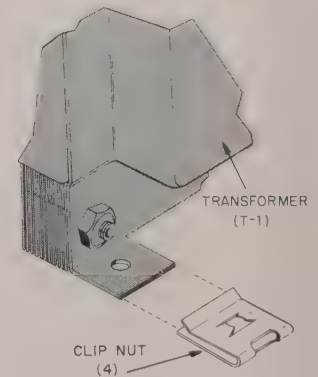


FIGURE 29. MOUNTING A CLIP NUT ON T-1

SIXTH WIRING OF THE CHASSIS

SEE FIGURE 30

☒ PC-2, prepared packaged circuit. Connect the leads of PC-2 as follows:

NOTE: the numbers stenciled on PC-2 will not be visible when the part is correctly mounted.

- ☒ Solder no. 1 to terminal 1 of TS-1 (3 wires).
- ☒ Solder no. 2 to terminal 4 of R-52.
- ☒ Solder no. 4 to terminal 5 of R-52 (2 wires).
- ☒ Solder no. 5 to terminal 6 of R-52.
- ☒ Solder no. 3 to terminal 4 of R-53.
- ☒ Solder no. 6 to terminal 5 of R-53.
- ☒ Solder no. 7 to terminal 6 of R-53 (2 wires).

NOTE: It may be necessary to move the small board to the lowered position for access to TR-11 and TR-22.

- ☒ 7¼" black wire. Solder one end to terminal B of TR-11 (2 wires). Push the other end through the clamp and through ½" large black tubing. Solder this end to terminal 8 on the small board.
- ☒ 7½" brown wire. Solder one end to terminal C of TR-11 (3 wires). Push the other end through the clamp and tubing. Solder this end to terminal 6 on the small board.
- ☒ 8" red wire. Solder one end to terminal E of TR-11. Push the other end through the clamp and tubing. Solder this end to terminal 3 of the small board.
- ☒ Free end of the white/orange wire from TS-7. Push through a ½" length of large black tubing and solder to terminal 15 on the small board.
- ☒ Free end of the white/yellow wire from TS-7. Push through tubing and solder to terminal 11 on the small board.
- ☒ 14" white/yellow wire. Solder one end to terminal 4 on the large circuit board. Feed the other end through all the clamps and tubing shown. Solder this end to terminal 13 of the small board.
- ☒ Small pre-wired circuit board and hinge. Fasten the hinge to the component side of the board with two 4-40 x 3/16" screws, lockwashers and nuts. Refer forward to Figure 33 on page 39 for a picture of the hinge in place. The hinge must be mounted exactly as shown. Now mount the hinge on the two spacers next to the power supply with two 4-40 x 5/16" screws and lockwashers.

- ☒ 10½" yellow wire. Solder one end to terminal 3 on the large circuit board. Feed the other end through the clamps and tubing. Solder this end to terminal 17 on the small board.
- ☒ 7½" brown wire. Solder one end to terminal B of TR-20. Route the other end through the clamp and tubing. Solder this end to terminal 16 on the small board.
- ☒ 9" orange wire. Solder one end to terminal B of TR-9. Route the other end through the clamp and tubing. Solder this end to terminal 12 on the small board.
- ☒ 7¼" black wire. Solder one end to terminal E of TR-10. Push the other end through the tubing and solder it to terminal 7 on the small board.
- ☒ Black lead from T-3. Push through the clamp and tubing and solder to terminal 18 on the small board.
- ☒ Black lead from T-2. Push through the clamp and tubing and solder to terminal 14 on the small board.
- ☒ Gray wire. Solder one end to terminal 1 of TS-4 (2 wires). Route the other end through the clamp and tubing. Solder this end to terminal 2 on the small board.
- ☒ 6½" white wire. Solder one end to terminal E of TR-21. Route the other end through the clamp and tubing. Solder this end to terminal 5 on the small board.
- ☒ 6" white/red wire. Solder one end to terminal E of TR-22. Push the other end through the tubing and solder it to terminal 1 on the small board.
- ☒ 2½" white/green wire. Solder one end to terminal B of TR-22 (2 wires). Solder the other end to terminal 9 of the small board.
- ☒ 3½" white/black wire. Solder one end to terminal C of TR-22 (3 wires). Solder the other end to terminal 4 on the small board.
- ☒ Free end of yellow wire from TS-2. Connect to terminal 10 on the small board.
- ☒ 4¼" white/red wire. Solder one end to terminal 1 of TS-9 (2 wires). Push the other end through the tubing and solder it to terminal 10 on the small board (2 wires).
- ☒ Make sure all wiring to the small circuit board is correct. In the next step the board will be fastened in place and this wiring will be covered.
- ☒ Carefully swing the board down on its hinge, toward the chassis. Position wires as necessary to clear the board.

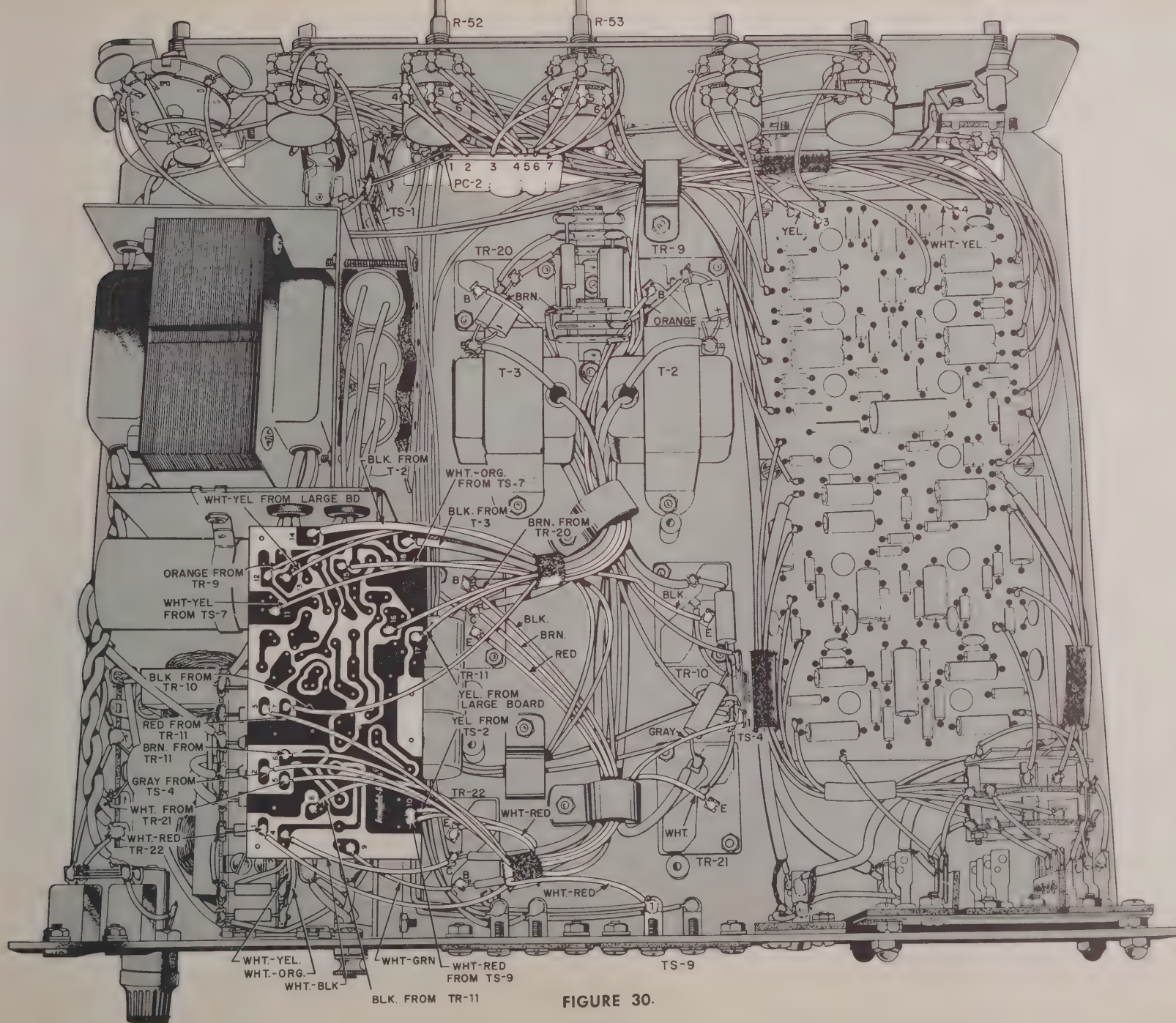


FIGURE 30.

FINAL WIRING

SEE FIGURE 33.

- ☒ Secure the small circuit board with two 4-40x5/16" screws at outer corners. The screws will thread into the spacers below.
- ☒ Free end of violet wire from TS-7. Solder to terminal 10 on the small board.
- ☒ C-65, 2,000 μ f electrolytic capacitor. Using plastic clamp mount to the clip nut on the power supply bracket. Use a 6-32x5/16" screw. Bend the capacitor mounting clamp until the capacitor is positioned as shown in Detail A.
- ☒ Solder the red wire from C-65 to terminal 1 of TS-5 (4 wires). Solder the yellow wire from C-65 to terminal 2 of TS-6 (3 wires). Dress excess lead length under the power supply assy.
- ☒ Line cord and bushing. Install the line cord and bushing, as shown in Detail B on Figure 33. Line cord ends must extend 2" beyond the bushing before snapping the bushing into place. Use pliers to compress the bushing.
- ☒ Solder either of the line cord ends to terminal 4 of TS-5 (3 wires). Solder the other line cord end to terminal 2 of J-6 (3 wires).
- ☒ F-1, 1.5 amp fuse. Install in fuse holder F-1.
- ☒ F-2 and F-3, 3 amp fuses. Install in fuse holders F-2 and F-3.

DO NOT plug the line cord into an outlet at this time; construction is not complete!

- ☐ I-1 and I-2, large bulbs with four leads. Notice that two of the leads are covered with red tubing. This tubing **MUST** remain on these leads. Separate the four leads and slip $\frac{3}{4}$ " of small black tubing over the uncovered leads, as shown in Figure 31.

SEE FIGURE 32.

Connect I-1 to the terminals on the small circuit board as follows:

- ☐ Solder a red lead to terminal 1.
- ☐ Connect the other red lead to terminal 2.
- ☐ Solder a black lead to terminal 4.
- ☐ Solder the other black lead to terminal 5.
- ☐ I-2, the remaining large bulb. Prepare in the same manner as I-1.

Connect I-2 to terminals on the small board as follows:

- ☐ Solder a red lead to terminal 2 (2 wires).
- ☐ Solder the other red lead to terminal 3.
- ☐ Solder a black lead to terminal 6.
- ☐ Solder the other black lead to terminal 7.

- ☒ Your wiring is now complete. Every terminal should be soldered and each wire in each terminal should be soldered. If a connection looks doubtful, reheat it and add a little fresh solder if needed.

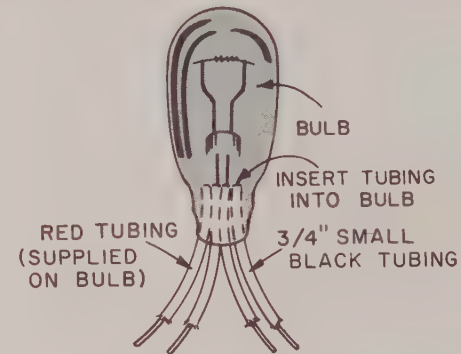


FIGURE 31. PREPARATION OF I-1 AND I-2

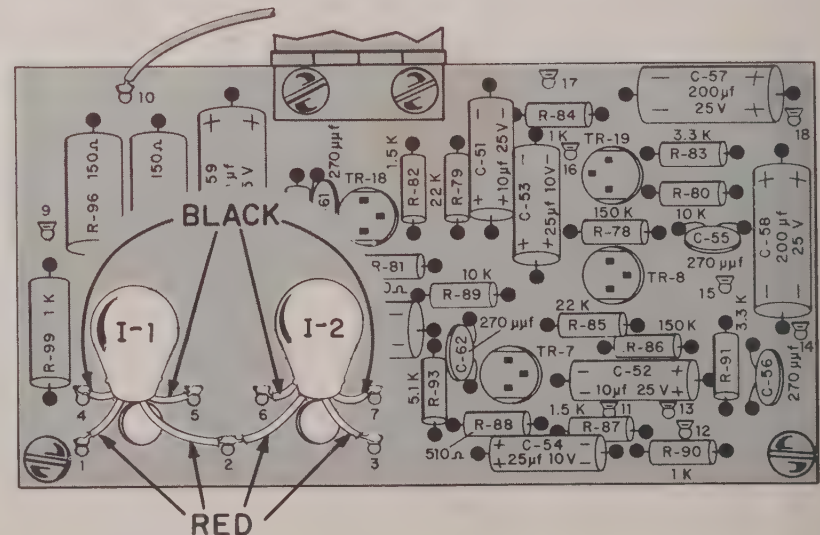


FIGURE 32. WIRING OF I-1 AND I-2

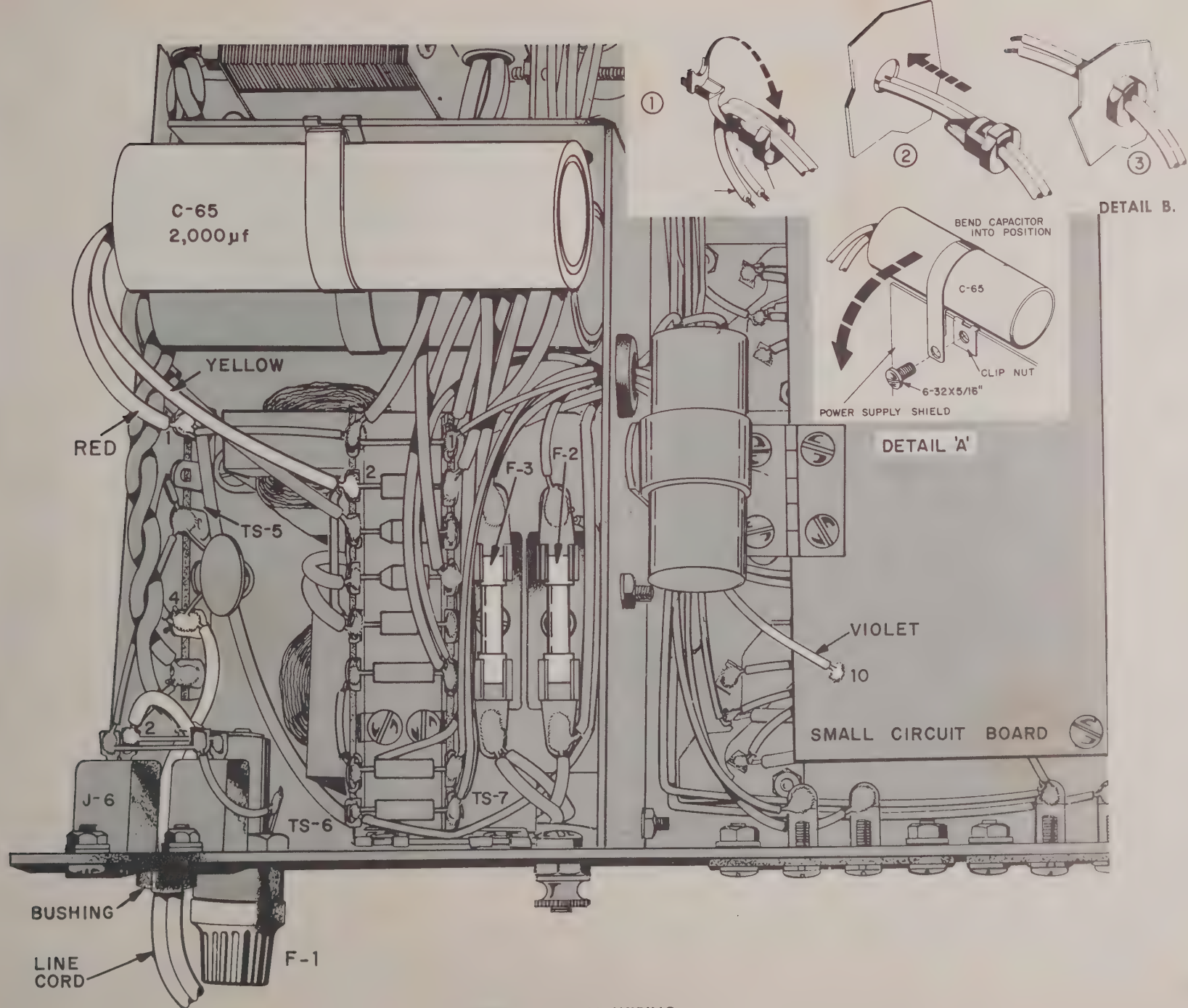


FIGURE 33. FINAL WIRING

TRANSISTOR INSTALLATION

SEE FIGURE 34.

Mount each of the following transistors with an insulator and two #6x 1/2" self-tapping screws as shown in Figure 35. Power transistors are installed correctly, only when the mounting holes line up with the chassis holes.

NOTE: It may be necessary to straighten the transistor pins.

- ☐ TR-9, part no. 660-076.
- ☐ TR-20, part no. 660-076.
- ☐ TR-10, part no. 660-077.
- ☐ TR-11, part no. 660-077.
- ☐ TR-21, part no. 660-077.
- ☐ TR-22, part no. 660-077.

SEE FIGURES 36 AND 37 ON PAGE 43.

The following transistors are mounted by inserting the leads into the sockets on the two circuit boards. Cut each transistor lead to 3/8" before installation.

NOTE: Your transistors may be either type shown in Figure 36.

For the small board:

- ☒ TR-7, part no. 660-074.
- ☒ TR-18, part no. 660-070.
- ☒ TR-8, part no. 660-070.
- ☒ TR-19, part no. 660-074.

For the large board:

- ☒ TR-1, part no. 660-082.
- ☒ TR-2, part no. 660-082.
- ☒ TR-12, part no. 660-082.
- ☒ TR-13, part no. 660-082.
- ☒ TR-3, part no. 660-124.
- ☒ TR-4, part no. 660-082.
- ☒ TR-5, part no. 660-082.
- ☒ TR-6, part no. 660-082.
- ☒ TR-14, part no. 660-124.
- ☒ TR-15, part no. 660-082.
- ☒ TR-16, part no. 660-082.
- ☒ TR-17, part no. 660-082.

CAUTION: Do not operate the amplifier until the test procedure on Page 44 has been completed.

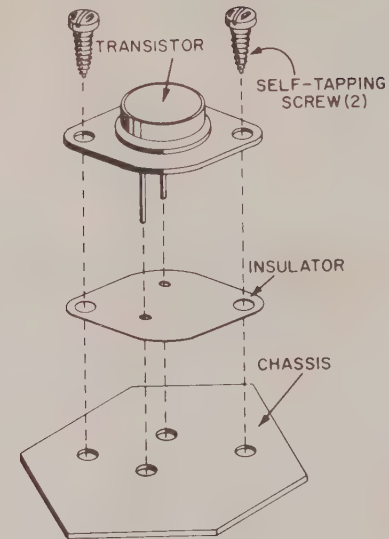


FIGURE 35. POWER TRANSISTOR MOUNTING

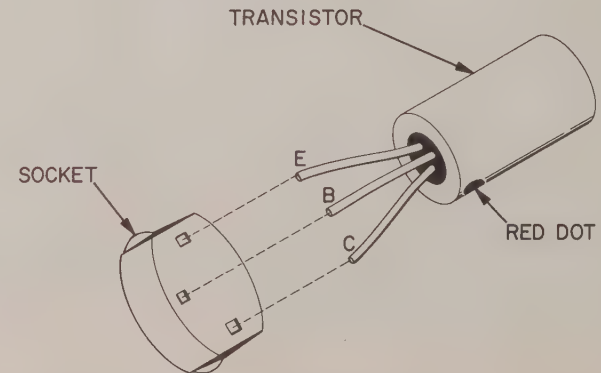
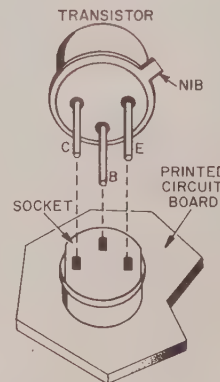
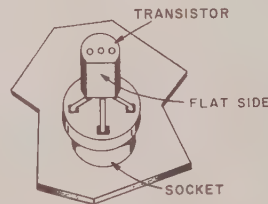


FIGURE 36. SMALL TRANSISTOR SOCKET TYPES

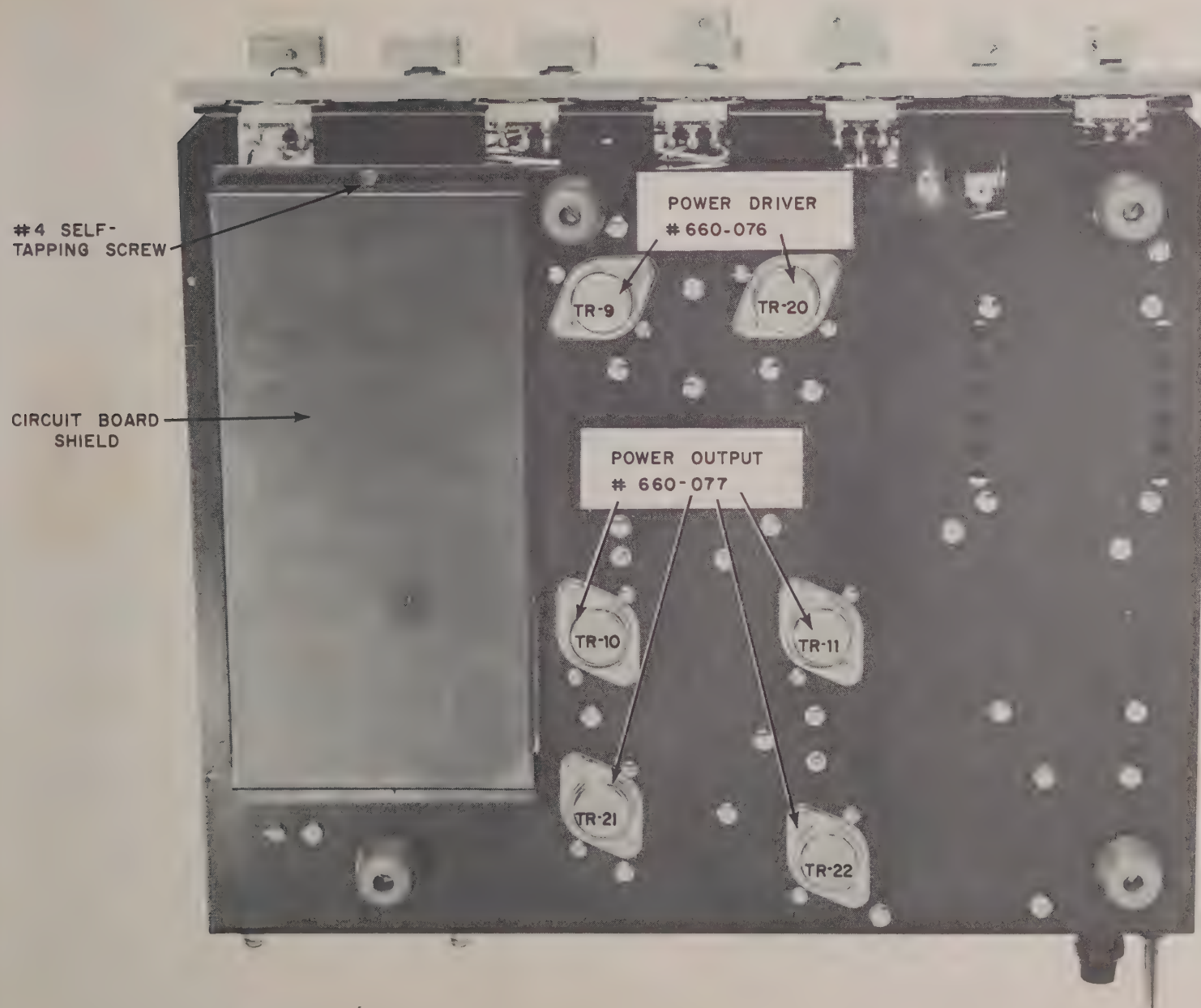


FIGURE 34. POWER TRANSISTOR LOCATION

FINAL ASSEMBLY

- ☒ Circuit board shield. Thread a #4 self-tapping screw into the four small holes in the shield; then remove them. This will pre-tap the holes, making it easier to secure the circuit board cover later.
- ☒ Refer back to Figure 34. From the bottom of the chassis, carefully push the circuit board shield into place. All wires connected to the large circuit board must fall **inside** the shield. Fasten the shield with two #4 self-tapping screws. **BE SURE** that the shield does not touch the bottom of the circuit board, or any wires that might extend from the foil. Ends of wires connected to the top of the board must not touch the shield.
- ☒ Retaining clip. Refer to Figure 37, Detail A. Slide the clip down into the slot in the side of the circuit board shield closest to the edge of the chassis. Hold the clip firmly against the chassis and fasten with a #10 self tapping screw.
- ☒ Circuit board cover. Place the cover over the shield and fasten with four #4 self-tapping screws. Screws go through the cover into the pre-tapped holes.
- ☒ Input panel shield. Install as shown in Figure 37, Detail B. Loosen the two acorn nuts holding the top of the input panel, insert the shield, and re-tighten the nuts.
- ☒ Transistor identification label. Carefully remove the protective backing from the label. This exposes the pressure sensitive surface. Carefully center the label on the circuit board cover. Start with one end of the label; then work toward other end to prevent wrinkles.
- ☐ Fiber cover. Mount as shown in Figure 37, Detail C. This covers the AC power connections, if you operate this unit out of a cabinet.
- ☒ Front panel and pilot light jewel. Press the jewel into the hole beneath the **LEVEL** marking.

CAUTION: The preliminary test on page 44 of this manual **MUST BE** made before mounting the amplifier in a cabinet or connecting your speakers. **SERIOUS DAMAGE** could result if this test is omitted.

DRESS PANEL AND KNOB ASSEMBLY

SEE FRONT COVER PHOTO.

- ☒ Place the dress panel over the control shafts. Secure the panel temporarily with a $\frac{3}{8}$ " flat washer and nut on the **LEVEL** and **FILTERS** shafts.
- ☒ Check to see if any of the slide switches bind against the dress panel. If they do, note in which direction you must move each switch to correct this condition. Remove the front panel and re-position the switches.
- ☒ Remount the dress panel and secure with seven $\frac{3}{8}$ " flat washers and nuts. Note: Do not make the nut on the **SELECTOR** bushing tight.
- ☒ Place a $\frac{3}{8}$ " flat washer and knurled nut on the headphone jack. Tighten with fingers only to avoid scratching your dress panel.
- ☒ Turn the shafts of all controls fully counterclockwise.
- ☒ Thread a $\frac{7}{16}$ " setscrew into one of the large knobs. Place the knob over the **SELECTOR** switch shaft. Tighten the setscrew with the dot on the knob facing the **TAPE** line.
- ☒ Thread $\frac{7}{16}$ " setscrews into the two remaining large knobs. Place the knobs on the **LEVEL** and **LOUDNESS** shafts. Tighten setscrews with dots at 7 o'clock.
- ☒ Two large knobs with center holes only. Slip one over the **BASS** shaft and one over the **TREBLE** shaft. Knobs will index with outer portion of shafts when dots are in the 7 o'clock position.
- ☒ Two small knobs with small shaft holes. Thread $\frac{1}{4}$ " setscrews into each one. Place the knobs over the small **BASS** and **TREBLE** shafts. Tighten with dots in the 7 o'clock position.
- ☒ Small knob with large shaft hole. Thread a $\frac{1}{4}$ " setscrew into the knob. Place on the **BALANCE** shaft and tighten screw with dot in the 7 o'clock position.
- ☒ Small knob with large shaft hole. Thread a $\frac{1}{4}$ " setscrew into the knob. Place on the **FILTERS** shaft and tighten setscrew with dot in the **FLAT** position.

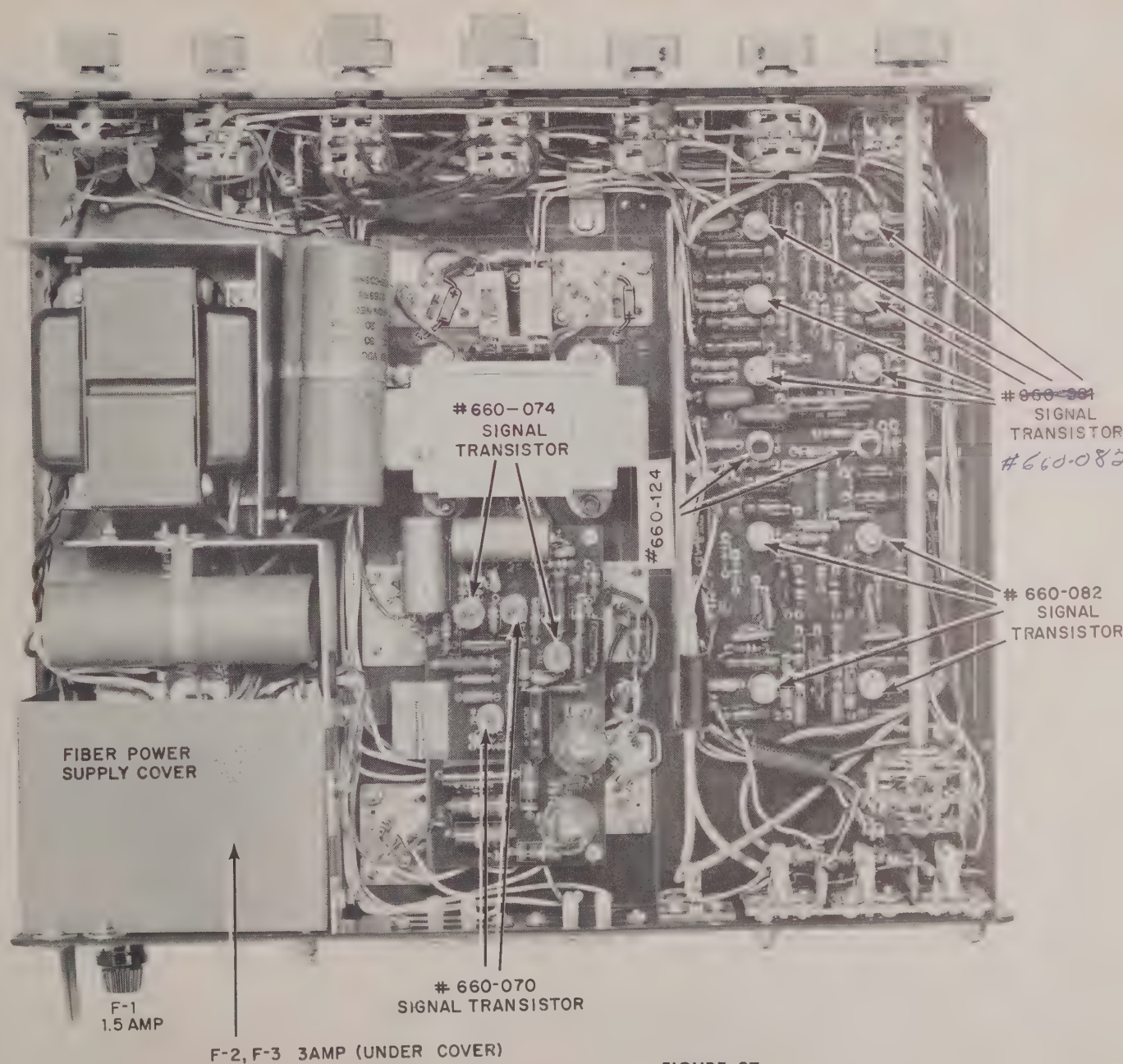
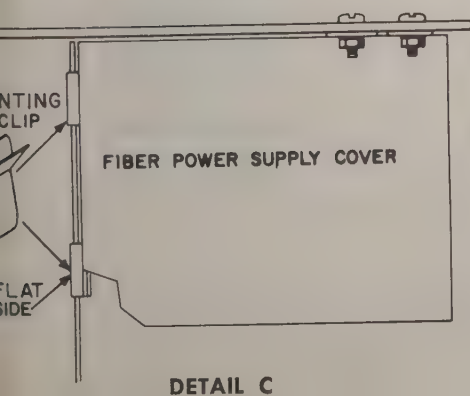
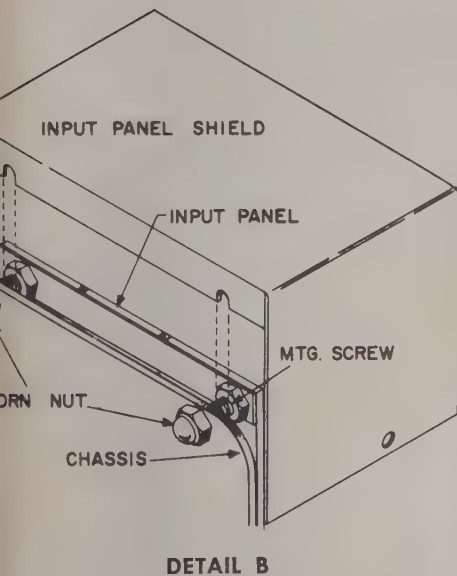
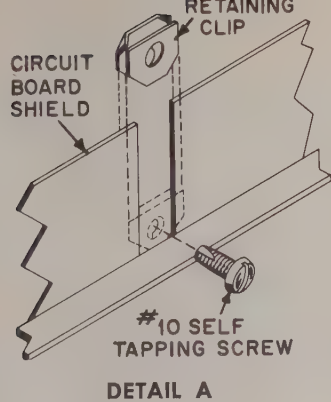


FIGURE 37

PRELIMINARY TEST

THE FOLLOWING TEST MUST BE MADE BEFORE CONNECTING YOUR SPEAKER SYSTEMS TO THE AMPLIFIER OUTPUT TERMINALS, OR INSTALLING IN A CABINET. SERIOUS DAMAGE COULD OCCUR IF THIS TEST IS OMITTED.

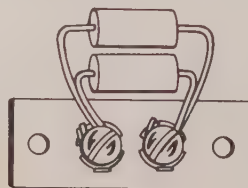
- ☐ Four 15 Ω 1-watt resistors (brown, green, black). Connect 2 resistors across the RIGHT output terminals AS SHOWN AT THE BOTTOM OF THIS COLUMN. Connect the other 2 across the LEFT output terminals.
- ☐ Set power OFF, STEREO-MON switch to STEREO, BALANCE mid-way. LEVEL control MUST BE MINIMUM or FULLY COUNTER-CLOCKWISE.

NOTE: DO NOT CONNECT ANY EXTERNAL SIGNAL SOURCE (TUNER, PHONO, ETC.) TO THE AMPLIFIER INPUTS FOR THIS TEST.

- ☐ Plug the line cord into a 120 V AC outlet.
- ☐ Locate emitter lamps, I-1 and I-2, on the small circuit board. In the next step, closely watch both filaments in each lamp. Perform the next step quickly.
- ☐ Turn the OFF-POWER switch to POWER, while watching the lamps. TURN THE POWER OFF IMMEDIATELY if either lamp lights or glows and refer to the output-circuit troubleshooting-chart. A GLOWING OR LIGHTED LAMP INDICATES A SERIOUS WIRING ERROR THAT MUST BE CORRECTED BEFORE THE UNIT IS TURNED ON AGAIN.
- ☐ If the pilot lamp lights, emitter lamps I-1 and I-2 do not light or glow, and fuses F-2 and F-3 are not blown, it may be assumed that the output circuit is operating properly.

NOTE: R-94 and R-95 are 7-watt resistors, designed to dissipate considerable heat. These resistors normally run quite hot, so do not touch them.

- ☐ Turn the power off.
- ☐ Remove the resistors from the output terminals.
- ☐ Proceed with cabinet installation and equipment connection.



OUTPUT CIRCUIT TROUBLESHOOTING CHART

NOTE: NO SIGNAL APPLIED TO AMPLIFIER, LEVEL CONTROL SET AT MINIMUM.

SYMPTOM	POSSIBLE CAUSE	SERVICE PROCEDURE
I-1 or I-2 light brightly as soon as power is applied.	Emitter to collector short at output transistor(s).	Check all wiring to E and C terminals of TR-10, 11, 21 and 22.
One filament in each lamp lit, or glowing.	Improper B+ wiring.	Check soldering of red wire at terminal 1 and 3 of TS-3. Check violet wire from terminal 1 of TS-4 to terminal 3 of TS-3.
One or more filaments lit or glowing.	Shorted base to collector at TR-10, 11, 21, and 22. Shorted resistor, R-98, 99, 100 and 101.	Check all wiring to B and C terminals of these transistors. Check resistors for shorted condition with ohmmeter. (Disconnect one lead of each resistor being checked).
Either filament of I-1 or I-2 lights or glows.	Open in either secondary side of driver transformers, T-2 and T-3.	Disconnect red lead from either transformer, and check for 1.5 Ω with an ohmmeter to the red/yellow lead. Disconnect green lead from either transformer and check for 1.5 Ω to green/yellow lead. Check other transformer in the same manner. If ohmmeter indicates no continuity in either winding, replace defective transformer. Carefully resolder all leads.

ACCESSORY CABINETS

INSTALLING THE AMPLIFIER IN THE METAL CABINET

- ☐ Slide the cabinet over the amplifier. The ventilation slots go toward the rear.
- ☐ Fasten cabinet to amplifier chassis with four #4 x 1/4" thread-cutting screws.

INSTALLING THE AMPLIFIER IN THE WOOD CABINET

SEE FIGURE 39.

Hardware for the following steps is supplied with the cabinet.

- ☐ Slide the front of the amplifier into the rear of the cabinet. The bottom edge of the chassis will slide down grooves in each side of the cabinet. Push the amplifier all the way in to the end of the grooves.
- ☐ Fasten the front edge of the chassis to the cabinet with a 5/8" self-tapping screw and flat washer.
- ☐ Fasten the rear of the amplifier with two metal brackets. Use two #6 x 1/2" wood screws in the cabinet and two #4 x 1/4" thread cutting screws in the chassis.
- ☐ Four rubber feet. Mount to cabinet with #6 x 1/2" wood screws.

**SEE YOUR OPERATOR'S MANUAL
FOR PROPER HOOKUP, OPERATION,
AND CUSTOM MOUNTING.**

**If your amplifier does not operate properly,
refer to the service hints in this manual.**

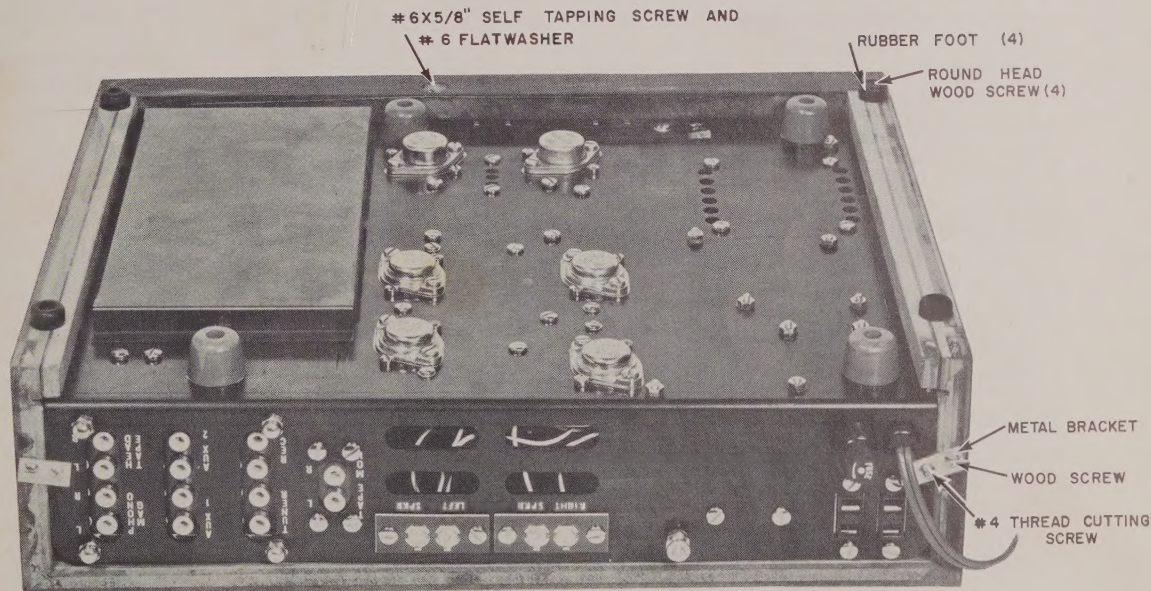


FIGURE 39. WOOD CABINET INSTALLATION

SERVICE HINTS

If the amplifier does not work properly, carefully recheck all wiring. Look for poor solder connections and possible accidental shorts between terminals that should not be connected. Because of the high currents typical of transistor amplifiers, it is extremely important that all connections be well soldered. Cold solder joints can cause the unit to oscillate and hum. Cold solder joints are formed when insufficient heat is used in soldering and the solder, therefore, has not flowed throughout all wires in the connection. If any connection looks doubtful, reheat it and add a small amount of fresh solder, if needed.

When you check your wiring, have someone else, if possible, also check your work. A second person can often find a small error which you have repeatedly overlooked.

CAUTION

Remove the line cord from the AC outlet before changing transistors or connecting test equipment. When you change transistors on printed circuit board be sure to insert the new unit properly. If transistors are plugged in backward, they may be permanently damaged.

Because of the high sensitivity of this amplifier it is recommended that shorted phono plugs be inserted in all unused low-level input jacks. **TAPE HEAD** and **MAG PHONO** ARE YOUR low-level jacks.

TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	SERVICE PROCEDURE
UNIT DEAD		
Pilot lamp not lit, F-1, 2 and 3 not blown.	Open switch, linecord, or transformer primary.	Check switch and linecord wiring. Check transformer T-1.
F-1 only blown, pilot lamp not lit.	Shorted diode, electrolytic capacitor, or transformer.	Check CR-1 thru CR-4. Check C-64 thru C67 and C-72. Check T-1.
F-2 and F-3 blown, pilot lamp out.	Shorted electrolytic capacitor, or power transistor. Power transistors installed without insulating washers. Mis-wired small circuit board, or power transistors.	Check C-67, C-68, C-71 and C-72. Check power transistors. Install insulating washers. Check wiring.
No fuses blown, pilot lamp lit.	Mis-wired large or small circuit board.	Check wiring of both boards. Check wiring to both boards.
F-3 only blown.	Defective or mis-wired C-68, C-72, C-58.	Check C-68, 72 and C-58 and wiring. Replace F-3.
RIGHT CHANNEL DEAD		
F-2 blows, pilot lamp not lit.	Shorted C-57, 67, 71.	Check C-57, 67, 71. Replace F-2.
Left channel distorted, pilot lamp not lit.	F-2 blown.	Replace F-2.
Right channel dead.	Both filaments in I-1 open.	Replace I-1.
Right channel dead.	T-3 primary winding shorted.	Replace T-3.
R-94 smoking.	Shorted TR-18 or open TR-19. (27 volt drop across R-94 instead of 15 volts).	Replace TR-18 or 19. Check soldering of sockets.

TROUBLESHOOTING CHART—Cont.

TROUBLE	POSSIBLE CAUSE	SERVICE PROCEDURE
Right channel dead.	Open TR-18. (voltage drop across R-94 approx. 6V instead of 15V).	Check soldering of socket, or replace TR-18.
Right channel dead.	Shorted TR-19. (Voltage drop across R-94 approx. 4V, instead of 15V).	Check socket for solder short. Check TR-19 and replace if shorted.

LEFT CHANNEL DEAD

R-95 smoking.	Shorted TR-7 (voltage drop across R-95 27 V. instead of 15V).	Check socket for solder shorts. Check TR-7 and replace if necessary.
	Open TR-8 (voltage drop across R-95 27V. instead of 15V).	Check soldering of socket. Check and replace TR-8 if necessary.
Left channel dead.	Shorted TR-8 (voltage drop across R-95 zero volts).	Check soldering of socket. Check TR-8 and replace if necessary.
Left channel dead.	Open TR-7 (voltage drop across R-95 approx. 3V instead of 15V).	Check soldering of socket. Check TR-7, replace if necessary.
Left channel dead.	Shorted TR-8 (Zero volts across R-95).	Check socket for solder shorts. Check TR-8 and replace if necessary.
Left channel dead.	Bolt filaments of I-2 open.	Check I-2 and replace if necessary.
Left channel dead.	Shorted primary T-2.	Check wiring, and transformer. Replace T-2 if necessary.

DISTORTION

Distortion in one channel only.	One filament in I-1 or I-2 open.	Check I-1 and I-2, replace if necessary.
Distortion, both channels.	One secondary of T-2 or T-3 shorted. Shorted emitter to base of TR-10, 11, 21 or 22.	Check and replace T-2 or T-3. Check wiring. Check transistors, replace if necessary.

TROUBLESHOOTING CHART—Cont.

TROUBLE	POSSIBLE CAUSE	SERVICE PROCEDURE
Oscillation on one or both channels.	Poor ground connection (s).	Reheat solder lug connections. Tighten solder lug mounting screw. Be sure that solder lug is mounted directly to bright chassis. Re-solder all wires at terminal 2 of TS-10.

MISCELLANEOUS

C-57 and 58 overheating. Fuses F-2 and F-3 may be blown.	T-2 and T-3 black leads reversed. C-57 and C-58 installed with reversed polarity.	Reverse black leads, and/or replace C-57 and C-58.
Amplifier plays normally, one channel only.	Wiring error or defective transistor.	Determine which channel is at fault. Check wiring in this channel. Interchange like transistors from channel to channel until defective one is found. NOTE: Power must be off whenever transistors are changed.
Amplifier plays normally, one channel only. I-1 and I-2 are glowing.	Mis-wired small circuit board or power transistor in which channel bulb is lit. Shorted output.	Check all wiring of small board and power transistors. Check value of R-98 thru R-101. Check output terminals for possible shorted condition.
R-94 and R-95 Quite hot.	Normal condition, R-94 and R-95 are 7-watt resistors, designed to dissipate considerable heat. DO NOT TOUCH R-94 AND R-95.	NONE. NORMAL CONDITION.
TR-8 and TR-19 Running warm.	Normal condition. These are silicon transistors, designed to run warm.	NONE. NORMAL CONDITION.
I-1 and I-2 glowing intermittently while playing unit VERY loud on low impedance speakers.	Amplifier being over-driven.	NONE. LAMPS ARE PROTECTING OUTPUT TRANSISTORS FROM OVERLOAD.

